Ontario

Ontario's Anti-Smog Action Plan

PROGRESS THROUGH PARTNERSHIP

2002

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EXECUTIVE SUMMARY

The ASAP's key goal is to achieve a 75 per cent reduction in the average number of times the 80 parts per billion (ppb) one hour ozone Ambient Air Quality Criterion (AAQC) is exceeded. To achieve this, the ASAP participants endorsed a 45 per cent reduction of Ontario's emissions of nitrogen oxides (NO_x) and volatile organic compounds (VOCs) from 1990 levels by 2015. In addition, a commitment was made to reduce pollutants contributing to particulate matter by 10 per cent by 2015.

In August 2000, the ASAP progress report titled "Progress Through Partnership" was released. This report builds on that document, describing the progress that ASAP partners have made and evaluating past and anticipated actions to help guide anti-smog efforts in Ontario. Two themes - recognizing efforts and evaluating progress - guide the structure of this report, based on the ASAP framework for reporting progress that was endorsed by the ASAP Operating Committee in February 2001.

Recognizing Efforts: Highlights the activities of the ASAP partners - the industrial sector, transportation sector, as well as specific actions by ASAP government partners, non-government organizations and academic/research representatives. Initiatives that are both non-regulatory in nature (i.e., technology-related process improvements, public education, etc.) and regulatory (i.e., caps on electricity sector air emissions) are summarized to give an overview of the variety of work ASAP partners have undertaken since the ASAP was formed, and since 1998 when ASAP participants' progress was first surveyed.

Evaluating Progress: Looks at how Ontario is doing with respect to the goals for reductions of NO_x, VOCs, SO_2, and Particulate Matter ($PM_{2.5}$/PM_{10}). These pollutants are significant precursors of the two main components of smog, ozone and fine particles ($PM_{2.5}$) in ambient air, as well as acid rain. Reducing these precursors will also advance Ontario's commitment to achieve the Canada Wide Standards for $PM_{2.5}$ and ozone.

ASAP partners have made good progress toward achieving smog-reduction targets. Over a nine-year time frame, provincial emissions of NO_x, VOCs and SO_2 have decreased by 17 per cent, 20 per cent, and 50 per cent, respectively. Between 1998 and 1999, increases have occurred in NO_x and VOC emissions from off-highway engines, and some industrial point sources. SO_2 emissions have declined significantly over this year period, by almost 14 per cent.

Looking to the future, an analysis of forecasted estimates indicates that more work may be required to achieve anti-smog targets. As part of its Clean Air Plan for Industry announced in October 2001, the government is proposing to advance the target date for a 45 per cent reduction in province-wide NO_x emissions to 2010 from 2015. As well, the government is proposing to reduce province-wide emissions of SO_2 by 50 per cent by 2010, five years ahead of the initial 2015 target date. Depending on future reduction scenarios related to the transportation and manufacturing sectors, additional emission reductions required to achieve the NO_x target by 2010 would be in the range of 33 to 71 kilotonnes. The scenarios suggest that to achieve the emission target by 2015, a reduction of up to 57 kilotonnes would be required.

For VOCs, the estimated projections indicate that additional reductions in the order of 88 to 134 kilotonnes would be required to achieve the VOC emissions level target of 477 kilotonnes by 2010. To do so by 2015, additional reductions of 77 to 130 kilotonnes would be required.

ASAP initiatives have also helped Ontario to achieve SO_2 reductions towards its commitment of 442.5 kilotonnes (50 per cent of the Countdown Acid Rain Cap). Additional reductions of 102 to 109 kilotonnes would be required to meet the SO_2 target by 2010, and to do so by 2015, a reduction of 102 to 112 kilotonnes would be needed.

Work has continued in the area of particulate matter reductions and the extent to which we understand the impacts of ASAP initiatives on Ontario's air quality. A number of industry partners have made in-roads in reducing primary particulate emissions, and reductions of NO_x, VOCs and SO_2 have contributed to lowering secondary particulate. ASAP has spearheaded considerable research on understanding the sources and emissions of PM_{10} and $PM_{2.5}$ in Ontario. ASAP's research partner, the Centre for Earth and Space Technology (CRESTech), has been instrumental in advancing our progress in understanding this smog constituent.

Interpreting progress in reducing smog levels in Ontario requires an analysis of both ozone data as well as fine particles - the two constituents of smog. When data from a more extensive $PM_{2.5}$ monitoring effort - over several years - are analyzed, the full smog problem may be tracked and better understood. In the interim, ozone exceedance data indicate that trends are influenced by meteorological influences and transboundary flows of pollution. Despite significant reductions in smog causing pollutants since 1990, the 1999 smog season saw the highest number of ozone exceedance days due to an increase in the number of hot days. And since more than 50 per cent of provincial ozone levels are due to the long-range transport of ozone and its precursors from the U.S., it is paramount that reductions of NO_x and VOCs here in Ontario be matched by efforts south of the border in order to achieve our provincial targets and improvement in air quality.

Since 1996, the Anti-Smog Action Plan (ASAP) has provided a unique forum for smog (ground level ozone and fine particulate matter) reduction in Ontario.

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CHAPTER 1

1.0 Report Overview

PURPOSE - RECOGNIZING EFFORTS AND EVALUATING PROGRESS

To estimate where we will be with respect to achieving smog reduction targets by 2010 and 2015, industry representatives provided best estimates of emissions projections encompassing production growth as well as reduction technologies anticipated to be implemented in the future.

Building on the first Anti-Smog Action Plan (ASAP) progress report released by the Ministry of the Environment (MOE) in August 2000, the two key themes of this report from Ontario's ASAP are:

- *Recognizing Efforts*: By highlighting the variety of practices that have been, or are planned to be implemented to achieve the Ontario smog reduction targets, anti-smog participants can learn from one another and encourage similar actions.
- *Evaluating Progress:* By evaluating where we are with respect to achieving provincial smog targets we will better understand the reductions and actions needed in the future.

APPROACH TO EVALUATING PROGRESS[1]

Assessing Where We are Now - Current Emissions and Trends

Emissions data, smog reduction progress and future and planned initiatives have been identified through several sources. In the fall of 2000, a survey on emissions data and smog reduction initiatives was undertaken by ASAP's Performance Monitoring and Reporting Working Group (PM&RWG) for ASAP partners and non-partners. For the most part, the surveys were effective in confirming the baseline smog-forming emission levels, as well as emissions in 1999[2] (the most recent reporting year at the time of the survey). Where survey data were unavailable, information was obtained from the Ministry of the Environment and Environment Canada to supplement the surveys.

The timeframe of reporting progress spans from the ASAP baseline years to the end of the year 2001, using best available data (1999) and information.

Assessing Where We Will Be - Future Emission Levels

To identify progress made with respect to provincial targets for smog reduction, forecasts of emissions are required. Modeling emissions growth is a complex task in the absence of information regarding the type of technology that may be implemented in the future to reduce emissions. To estimate where we will be with respect to achieving smog reduc-

[1] In December of 2000, the ASAP Executive Committee (EC) endorsed a framework for reporting ASAP progress to guide the scope of ASAP initiatives to be included, the time frame of reporting, and the process for engaging input. This framework guides the progress report.

[2] MOE's emissions data (1990 and 1999) have been refined with the assistance of ASAP partners representing industrial sectors.

[3] Prior to selecting this method, two other options were considered: using forecasted values modeled by Environment Canada and a consultant, and second, using potential growth scenarios. The ASAP's Performance Monitoring and Reporting Working Group determined that the forecast models applied a different approach to forecasting emissions, resulting in varied growth estimates for the future. Using a range of potential growth scenarios for industry emissions was considered inconsistent with likely future emissions by some members of the Operating Committee.

tion targets by 2010 and 2015, industry representatives provided best estimates of emissions projections encompassing production growth as well as reduction technologies anticipated to be implemented in the future[3]. For non-respondents, forecasted emissions were estimated based on growth rates which ranged from -1 per cent growth per year to 1 per cent growth per annum. These growth ranges are only intended to provide a sense of future production levels and do not correlate to economic growth since increased economic output and productivity does not necessarily yield increases in emissions levels if technologies are implemented that reduce emissions. More detail on industry projections, and ascertaining future emissions from the transportation as well as residential and commercial sources can be found in Section 3.0.

To provide descriptions of past and future smog reduction initiatives made by ASAP partners, surveys, ASAP participants' Web sites, and annual and environmental reports were used.

LAYOUT OF REPORT

The section "*Recognizing Efforts*" highlights activities of the ASAP partners - the industrial sector (point and area sources), transportation sector, as well as specific actions by ASAP government partners, non-government organizations and academic/research representatives. Initiatives that are both non-regulatory in nature (i.e., voluntary process improvements, public education, etc.) and regulatory (i.e., caps on electricity sector air emissions) are summarized to give an overview of the variety of work ASAP partners have undertaken since the ASAP was formed, and since 1998, the year ASAP participants' emissions were surveyed (for the first progress report released in August 2000).

"*Evaluating Progress in Achieving Smog Targets*" reviews where we stand in terms of the goals for reductions of the significant precursors of the two main components of smog, ozone and fine particles ($PM_{2.5}$) in ambient air, as well as acid rain. Reducing these precursors will also advance Ontario's commitment to achieve the Canada Wide Standards for $PM_{2.5}$ and ozone.

The third major section of the report describes complementary air quality initiatives undertaken outside of the ASAP forum, especially by regional governments, the Ministry of the Environment, and Environment Canada. The final section summarizes the report's findings.

1.1 The Anti-Smog Action Plan

WHAT IS SMOG?

Smog is a mix of many pollutants. Its main components are ground-level ozone (O_3) and particulate matter. Ozone is a gas formed from Nitrogen Oxides (NO_x) and Volatile Organic Compounds (VOCs).

NO_x + VOC + Sunlight = Ozone

Fine particulate matter are tiny solids or liquid droplets (water is excluded by definition) that are either released directly into the air, or formed by reactions of chemicals in the air, including NO_x, VOCs, and Sulphur Dioxide (SO_2). Particulates are classified by their size. PM_{10} is particulate matter no greater than 10 microns and $PM_{2.5}$ is particulate no greater than 2.5 microns.

In southern Ontario, significantly higher concentrations of ozone are recorded on hot and sunny days between the months of May to September. Ozone and fine particulates are linked to a range of adverse human health impacts, including cardio-vascular and respiratory distress.

Ontario's NO_x emissions are predominantly from transportation sources (including off-road sources) which account for 64 per cent of total provincial NO_x emissions (1999 data). The electricity sector accounts for approximately 17 per cent of NO_x emissions, while emissions from other industrial sources account for 16 per cent of NO_x emissions. Provincial emissions of VOCs are dominated by four major sources - transportation (30 per cent) and residential (12 per cent), general solvent use (23 per cent) and manufacturing point sources (17 per cent). Approximately 70 per cent of Ontario's SO_2 emissions are attributed to major point sources, especially nickel smelters (INCO and Falconbridge in the Sudbury Region) and Ontario Power Generation's six fossil fuel generating stations.

The generation, build up and transport of smog over eastern North America is strongly influenced by weather systems. During the summer months, winds typically flow from the south and south west, carrying significant amounts of ground level ozone and smog precursor emissions into Ontario from the United States. During periods of widespread elevated ozone, it is estimated that more than 50 per cent of Ontario's smog can be attributed to trans-boundary air pollution.

THE ANTI-SMOG ACTION PLAN

Since 1996, the ASAP has provided a unique forum for addressing smog in Ontario. ASAP participants recognize that reducing smog in the province is a responsibility shared by government, non-government organizations, industry, as well as individuals. More than 50 organizations representing government and industry (companies or associations) have signed the Anti-Smog Accord, an agreement which endorses a range of reduction measures to achieve Ontario's

smog goals. The following section outlines the goals of the ASAP and its structure.

THE ANTI-SMOG ACTION PLAN GOALS

The goal of ASAP is to achieve, by 2015, a 75 per cent reduction in the average number of times the 80 ppb one hour ozone AAQC is exceeded. To achieve this, the ASAP partners endorsed a target of reducing the total provincial emissions of NO_x and VOCs by 45 per cent (from 1990 levels) by 2015.

Fine particulate matter is also a key component of smog. In 1996, as scientists were trying to better understand the source/receptor relationship of fine particulate, an interim measure was adopted - to achieve at least a 10 per cent reduction in emissions contributing to fine particulate matter. On June 6, 2000, the Canadian Council of Ministers of the Environment (CCME), ratified a Canada-Wide Standard (CWS) for ozone and fine PM ($PM_{2.5}$)[4]. This marked a significant step for ASAP - addressing the linkages between the two main smog components, ozone and fine particles, and their overlapping precursors.

Reductions in NO_x, VOCs and direct particle emissions(e.g., soot) will contribute to meeting the CWS for $PM_{2.5}$ but preliminary indications are that complying with the CWS for $PM_{2.5}$ will require significant reductions of SO_2, a major precursor leading to the formation of fine particulate matter (both PM_{10} and $PM_{2.5}$). For this reason, the report tracks emissions of SO_2 and progress made towards achieving SO_2 commitments. On January 24, 2000, as part of the province's contribution to the Canada-Wide Acid Rain Strategy for Post-2000[5], Ontario set a target of reducing SO_2 emissions by 50 per cent beyond the 1994 Countdown Acid Rain cap limits (which were still in place in 2000) by 2015.

ASAP PARTNERSHIP OVERVIEW

When the ASAP began in 1996, as the "Ontario Smog Plan", it was a multi-stakeholder forum representing industry (manufacturing, transportation, others), government and non-government that came together to develop and implement work plans for smog reduction. In 1999, the Plan was re-named as the "Anti-Smog Action Plan" and organizational changes were made. An ASAP Operating Committee (formerly called the "Smog Plan Steering Committee") became the driving force for developing, implementing and sharing success in smog reduction initiatives. The Operating Committee (OC) is

[4] The $PM_{2.5}$ CWS was established at 30 $\mu g/m_3$, 24 hour average, by 2010 (achievement to be based on the 98th percentile ambient measurement annually, averaged over three consecutive years). No CWS for PM_{10} was set at that time. The ozone CWS was established at 65 ppb, 8 hour average (based on the 98th percentile ambient measurement annually, averaged over a three year period).

[5] Ontario launched the Countdown Acid Rain Program in 1985, which committed the province to reducing SO_2 by 60 per cent (from 1980 base levels) by 1994. The current Countdown SO_2 cap is set at 885 kilotonnes per year; therefore, the target level for provincial SO_2 emissions is 442.5 kilotonnes per year. Ontario's target for 2015 reflects an 80 per cent reduction from 1980 base case levels.

CHRONOLOGY OF ACTION

1990: Canadian Council of Ministers of the Environment (CCME) released its Phase I NO_x and VOC Management Plan which identified the Windsor-Quebec Corridor as one of the regions of Canada where exposure to elevated levels of ozone is most extreme.

1994: Federal Environment and Energy Ministers called for a "next steps" NO_x /VOC strategy, as a follow-up to the 1990 CCME Plan.

June 1996: MOE released "*Towards a Smog Plan for Ontario*" and proposed emission reduction targets for discussion at a stakeholder workshop. Subsequently, the multi-stakeholder Smog Plan Steering Committee and sector/sub-sector Work Groups were formed to develop and implement a smog reduction process, focusing primarily on ozone.

November 1997: As a step towards addressing fine particulate, Ontario announced an interim ambient air quality criterion of 50 $\mu g/m^3$ for inhalable particulate expressed as a 24 hour average.

January 1998: "*Ontario's Smog Plan: A Partnership for Collective Action*" was published by the Steering Committee, representing, in the initial phase, the work of hundreds of partners and organizations. The centrepiece of the Smog Plan was Ontario's Smog Accord, which outlined the intent of 44 signatories to work towards specific emission reduction targets. Supporting the Smog Accord and Plan was Ontario's Smog Plan: Draft 1997 Work Group Reports Compendium Document, a 160-page document comprising Work Group work plans and reports, detailing the status of each Work Group in the planning process.

March 1999: After a concentrated one-year effort, the "Compendium of Fine Particulate Matter in Ontario" was released to the ASAP Operating Committee. This initiative provided a new focus on fine particles, especially $PM_{2.5}$ and its precursors, and underscored the linkages among fine particles, ozone and acid rain through their overlapping precursors. It also led to refocusing of ASAP onto both fine particles and ozone precursor reductions and to a need for a more comprehensive smog reduction strategy.

June 6, 2000: a Canada-Wide Standard (CWS) for ozone and fine PM ($PM_{2.5}$) was ratified by ministers at the Canadian Council of Ministers of the Environment (CCME). The $PM_{2.5}$ CWS was established at 30 $\mu g/m^3$, 24 hour average, by 2010 (achievement to be based on the 98th percentile ambient measurement annually, averaged over three consecutive years.) No CWS for PM_{10} was set at that time. This marked yet another step toward addressing the linkages between the two main smog components, ozone and fine particles, and their overlapping precursors. The parties to the CWS agreed to develop sectoral joint implementation actions (JIA) along with jurisdictional implementation plans, to lead towards compliance of the CWS.

August 2000: "*Progress Through Partnership*" was released, documenting some of the smog reduction activities that occurred between1996 and 1999, as the Smog Plan was being developed.

December 2000: The federal government signed the Ozone Annex to the Canada-U.S. Air Quality Agreement, agreeing to smog reduction targets for the electricity, transportation, and other sectors in the Pollutant Emissions Management Area (PEMA), including Southern Ontario.

October 2001: The Ministry of the Environment announced caps on the electricity sector's emissions of NO_x and SO_2 and introduced an emissions reduction trading program for Ontario. The new emissions caps came into effect January 1, 2002 and will reduce current Ontario Power Generation emissions of NO_x by 53 per cent and SO_2 by 25 per cent by 2007. At the same time, the government announced the final regulation requiring the Lakeview Generating Station in Mississauga to cease burning coal by April 2005. Ontario also announced its intention to begin consultation on introducing emissions limits for other major industry sectors in Ontario that emit NO_x and SO_2, and a proposal to move up the target date for NO_x and SO_2 reductions from 2015 to 2010, in keeping with the province's commitments on Canada-Wide Standards (discussed above).

comprised of representatives from government and non-government organizations, businesses representing Ontario's most important industrial sectors, and research institutions. These individuals have been charged with implementing the strategies and building the capacity required to achieve the ASAP goals. In August 2000, the Executive Committee was formed to guide and oversee the ASAP, including the OC and its working groups. Since 1999, the focus of the ASAP's efforts shifted to three priority areas: science and policy; tracking and reporting progress, providing recognition through awards and enhancing membership.

ASAP Operating Committee

Since the last progress report, the OC has undertaken numerous actions towards developing and

THE ANTI-SMOG ACCORD

Over 50 companies and associations have signed the Anti-Smog Accord

Adhesive and Sealant Manufacturers Association of Canada
Algoma Steel Inc. *
Altech Group *
Atlas Specialty Steels *
Automotive Industries Association of Canada
Automotive Parts Manufacturers' Association
Ball Packaging Products Canada Inc.
St. Mary's Cement (formerly Blue Circle)
Canadian Boiler Society
Canadian Chemical Producers' Association (Chemical Sector)
Canadian Farm & Industrial Equipment Institute
Canadian General Tower
Canadian Manufacturers of Chemical Specialties Association
Cement Association of Canada, Ontario Region
Canadian Paint & Coatings Association
Canadian Petroleum Products Institute
ChemCraft International Limited
Collision Industry Action Group
Consumers' Association of Canada
Co-Steel LASCO *
Crop Protection Institute
Crown Corke & Seal Canada
Dofasco Inc. *
Fabricated Plastics Limited
Falconbridge Limited
Gerdau Courtice Steel *
Hamilton District Autobody Repair Association
Hilton Works, Stelco Inc.
Inco Limited
John Deere Welland Works
Lafarge Canada Inc., Bath Cement Plant
Lafarge Canada Inc., Woodstock Plant
Lake Erie Steel Company Ltd. *
Lambton Industrial Society *
Ontario Ministry of the Environment
Motorcycle and Moped Industry Council
Ontario Federation of Anglers and Hunters
Ontario Greenhouse Vegetable Growers
Ontario Plastics Industry Association
Ontario Power Generation
Ontario Marina Operators Association
Ontario Natural Gas Association *
Private Motor Truck Council of Canada
Protect Air Inc.
Quebecor Printing Canada
Regional Municipality of Hamilton
Shorewood Packaging
Slater Steels - Hamilton Specialty Bar Division *
St. Lawrence Cement, Mississauga
Stelco Inc. *
Waterfront Regeneration Trust

* These organizations which appear with an asterisk (*) support the Ontario Smog Accord with exceptions, clarifications, or have expressed the need to review supporting documents.

implementing smog-reduction initiatives. Section 2.0 is dedicated to highlighting the Operating Committee's achievements.

ASAP Executive Committee

Since its first meeting in August 2000, the Executive Committee (EC) has provided guidance to the OC. EC members participated in a "Technical Smog Session" to provide them with an overview of smog impacts, the establishment of smog reduction targets and ASAP's progress. To learn more about the health impacts associated with smog, the EC invited Dr. Ted Boadway of the Ontario Medical Association (OMA) to speak about the OMA's report "Illness Costs of Air Pollution". In December 2000, the ASAP EC endorsed a framework for reporting progress that was shared with the OC and Performance Monitoring & Reporting Working Group. In the Spring of 2001, the EC carried out an exercise to develop their work plans and began the process of reviewing and developing the OC work plans.

PM-Ozone Science and Policy Assessment Working Group

A new multi-level strategy was the focus of the 2001 work plan of the Particulate Matter/Ozone Science and Policy Assessment Working Group (PM/O_3 SPAWG,), formerly PM/O_3 Options Assessment Working Group. The 2001 SPAWG work plan focused on gathering and assessing smog science, technical and policy information. The main accomplishments of the working group during the past two years include the development of a report assessment template, intended to provide an indication of the credibility of science and policy reports related to particulate matter and ozone.

Performance Monitoring and Reporting Working Group

The Performance Monitoring and Reporting Working Group (PM&RWG) has been dedicated to tracking and assessing 13 indicators of human health and environmental impacts of smog in Ontario (the number of ozone exceedances, transboundary emissions, etc.). In August 2000, the group released a report titled "Proposed Performance Indicators for Ontario's ASAP". The group also created an ASAP smog registry - an inventory of emissions for Ontario ASAP and non-ASAP partners. As part of this initiative, the group carried out a survey and compiled emissions data and reduction plans from ASAP and non-ASAP industry partners for compilation and analysis in this report.

ASAP Awards Program Committee

The Awards Committee framework was created in 2000 to develop an awards program to celebrate and recognize ASAP partners and non-partners that are committed to improving air quality in Ontario. The program builds on the existing Ministry of the Environment's Awards of Excellence Program. Nominees for an award must be innovative and benefit Ontario by making contributions to smog or green house gas emissions reduction in Ontario.

CHAPTER 2

2.0 Recognizing Efforts - Progress and Activities April 1999-October 2001

This section highlights some of the most recent activities and accomplishments undertaken by ASAP partners (signatories to the Anti-Smog Accord as well as those that participate at ASAP). The information is grouped by partners from various sectors - industry (point and area sources of emissions), transportation (both on and off road sources of emissions), as well as government, non-government and academia/research. Activities undertaken by organizations that complement the work of ASAP are discussed in the following section.

2.1 INDUSTRY SECTOR

Progress undertaken by ASAP's industry partners is highlighted in two parts. First, the ASAP partners whose emissions from point sources impact significantly on air quality are covered, followed by those partners engaged in improving their area source emissions.

POINT SOURCES

CEMENT

The cement manufacturing industry in Ontario emits significant quantities of NO_x and fine PM. The Cement Association of Canada (CAC; formerly Canadian Portland Cement Association), Ontario section, is represented by four companies with six manufacturing plants: St. Lawrence Cement, ESSROC Canada, Lafarge - Blue Circle Cement (merged in 2001) and Federal White. The Association has signed Ontario's Anti-Smog Accord and participates actively on the ASAP Operating Committee and working groups.

As reported previously, in 1998, the Association sent a Letter of Cooperation to the Ministry of Environment, outlining their plans to reduce emissions of smog causing pollutants. Among the commitments made were: installing continuous NO_x emissions monitoring (CEM) equipment; PM testing and characterization; surveying of NO_x emissions; and introducing available process technology to reduce NO_x emissions.

In the past years, CAC has installed CEMs in all gray cement kilns in Ontario and used an Expert Computerized System to avoid overheating of kilns. The use of indirect firing, alternative fuels, better operator training, overall energy efficiency measures, and modernizing combustion equipment have led to NO_x reductions and also helped reduce CO_2 emissions.

CAC is continuing efforts towards their multi-year NO_x reduction plan. CAC estimates that better cement kiln process control technology can further reduce NO_x emissions per tonne of product by about 15 per cent. CAC members have also implemented measures to control their emissions of SO_2 , which have increased since the last progress report. Some of the methods implemented for NO_x reduction have also led to SO_2 reductions, for example, optimized kiln temperature control and improved operator training. Increased SO_2 scrubbing efficiency through improved contact with lime particles will also be continued. Future efforts will include partial replacement of traditional fuels with lower sulphur alternative fuels.

Major achievements are being made in lowering emissions of total suspended particulates (TSP). Data (excluding fugitive emissions) provided by the Association indicates that TSP emissions were reduced by 36.4 per cent from 1990. These reductions were achieved with the use of continuous opacity measurement to optimize dust collector efficiency, improved preventive maintenance that avoided emergency dust releases, and state-of-the-art bag houses for kilns and clinker coolers. The Association is currently undertaking studies at Ontario-based plants to further characterize the fine particulate

matter emissions from cement operations. This will enable companies to develop an action plan to reduce fine particulate emissions.

STEEL

A signatory to the Anti-Smog Accord, the Canadian Steel Producers Association (CSPA) is comprised of nine Ontario-based steel and integrated steel companies.

CSPA members are continuing their efforts to comply with national emissions guidelines for industrial and commercial boilers and heaters (CCME National Emission Guideline for Commercial/Industrial Boilers and Heaters, 1998). By using low NO_x burners, replacing and rebuilding furnaces with low NO_x combustion technologies, CSPA is realizing lower NO_x emissions.

Electric arc furnaces are being used to boost production while achieving lower NO_x emissions. At Gerdau Courtice, the use of landfill gas in reheat furnaces is helping to lower NO_x concentrations (Canadian Steel Producers Association, Statement of Commitment and Action Regarding Environmental Protection).

Benzene, toluene and xylene are the major components of steel plants' VOC emissions. Some plants are following a benzene reduction strategy, in an effort to comply with a Strategic Options Report commitment to lower benzene emissions. For example, Stelco Hilton Works is continuing to implement the CSPA's Benzene Environmental Best Practices Manual for Coke Producers in Ontario to reduce coke oven by-product benzene. Other goals are to lower emissions from coke oven batteries and implement controls for storage tanks. Overall, steel plants have reduced benzene emissions by 57 per cent from 1993 levels in 2000 and have made commitments to make further reductions of 83 per cent by 2005 and 89 per cent by 2015, respectively, from 1993 levels.

To reduce SO_2 emissions, CSPA has implemented the following measures: desulphurized coke-oven gas and used low sulphur fuels wherever possible; implemented electric arc furnaces which are less energy intensive than the integrated steel making technology, and improved and fine tuned boilers as well as used wet scrubbers to remove significant amounts of SO_2. Stelco Hilton Works has begun to conduct analyses of the sulphur content of coke oven gas and blast furnace gas to enable more comprehensive emissions data calculations. The plant will also begin a stack testing program in 2001 to gather more information for site specific emission controls.

Steel plants are continuing their long-time efforts to control emissions of PM_{10} and $PM_{2.5}$. By focusing on green belting (to lower erosion of soil and protection from wind) and process changes, the CSPA has helped to lower particulate matter. At Dofasco, an aggressive green belt and paving program has been introduced to reduce particulate emissions from roads and open sources. In 1999, nearly 200,000 square feet of roads were newly paved and almost 10,000 square metres of their Hamilton property was improved through green belting projects. At Ivaco, a baghouse upgrade was undertaken to improve the reliability of the primary fume control system to help control particulate emissions. (Canadian Steel Producers Association, Statement of Commitment and Action Regarding Environmental Protection).

Many plants have also adopted Environmental Management Systems (EMS) and energy efficiency goals. For instance, Dofasco has committed to reducing energy consumption by one per cent a year from 2000 to 2010 to remain ahead of their Canadian Industry Program for Energy Conservation commitments. These actions complement other energy saving initiatives undertaken by CSPA companies, through such programs as Eco-geste and the Industrial Energy Innovator Program (Canadian Steel Producers Association, Report on the Environment 1998).

PETROLEUM REFINERIES

The Canadian Petroleum Products Institute (CPPI) is a signatory to the Anti-Smog Accord. The association is comprised of Canadian companies involved in the refining, distribution and marketing of petroleum products for transportation, home energy, and industrial uses. Members include Canadian Tire, Imperial Oil, Nova Chemicals, Petro-Canada, Safety-Kleen, Shell Canada, Sunoco and Ultramar.

Since its creation in 1989, the Institute has represented the views of its membership on a multitude of environmental issues and has established Environment, Health and Safety Guiding Principles for the safe handling of petroleum products and responsible refinery management (Canadian Petroleum Products Institute. CPPI Environmental and Safety Performance Report 1999). The seven refineries in the province also partake in efforts to reduce emissions of smog precursors.

To reduce NO_x emissions, CPPI members are continuing to use low NO_x burners and are optimizing operations with computerized controls and the recovery of waste heat. Low NO_x burner technology is expected to reduce NO_x emissions a further 50 per cent in new installations. CPPI also reports that future reduction plans include energy efficiency improvements by 1 per cent per year through to 2005.

To control VOC emissions, CPPI companies are continuing to implement their voluntary leak detection and repair (LDAR) program to more effectively measure and control refinery fugitive emissions. Upgrading of tanks, and tank protection devices to prevent overfill are other initiatives.

CPPI's ongoing emission reduction plans include flare gas recovery,

LDAR and enhanced storage tank vapour control programs. CPPI members are also planning to undertake a reduction plan for PM_{10} and $PM_{2.5}$, which will include finalizing the emissions estimation methodology and protocols, and quantifying emissions based on these protocols over the next couple of years.

Other voluntary and regulatory emission reduction efforts by CPPI companies related to fuels reformulation are covered under Section 2.2.

CHEMICALS

The Canadian Chemical Producers Association (CCPA) is comprised of 48 member companies and 78 plants in Ontario. The CCPA has signed the Anti-Smog Accord and participates at the ASAP Operating Committee table. Many initiatives by member companies have focused on achieving reductions of toxics identified under the Canadian Environmental Protection Act and other pollutants under their National Emissions Reduction Master Plan - CCPA Responsible Care (Canadian Chemical Producers Association, Responsible Care Annual Report).

In 1994, CCPA signed a Memorandum of Understanding (MOU) with Environment Canada and Industry Canada to reduce the release of chemical substances through voluntary actions under their Responsible Care program. The MOU expired on December 31, 1998. As a follow up, the CCPA, Environment Canada, and Ontario and Alberta Ministries of the Environment have developed and signed an umbrella MOU with an Annex on volatile organic compound (VOC) emission reductions. The MOU and VOC Annex have been developed in conjunction with the CCPA's Responsible Care Advisory Panel.

The Annex is a positive step forward in defining commitments to reduce VOC emissions. Twenty-five member companies participate in the MOU which covers 95 per cent of the VOC emissions from this sector. It is expected that member companies will achieve projected reduction levels on a facility basis. In Ontario, the projections represent an improvement in emissions reductions by 63 per cent by 2002 from a 1992 base year, and of 34 per cent from 1997 levels (CCPA VOC Annex, February 2001).

Many member companies have adopted CCME codes of practice (or their equivalent), including Fugitive Emissions, Storage Tank Emissions and Process Emissions for best practice approaches for VOC reductions (Canadian Chemical Producers Association, Reducing Emissions 8 Report).

FOCUS ON NOVA CHEMICALS

A significant portion of all VOC's released to the atmosphere are the result of fugitive leaks from the transfer and storage of feedstock or products. A significant area where fugitive leaks can occur is in rail loading yards when material is loaded into railcars. Nova Chemicals' rail loading area in Sarnia, Ontario includes 150 railcars used to transport styrene. Styrene is a VOC that contributes to the formation of smog and is a carcinogen. When Nova Chemicals redesigned their rail car loading area in 1999, operations personnel recognized the opportunity to reduce fugitive styrene emissions by retrofitting all their railcars with new loading equipment. The retrofit cost $1.25 million, and the new equipment allowed the loading of styrene into the railcars without the product ever being exposed to the air. The retrofit of Nova Chemicals railcars resulted in a reduction of fugitive styrene emissions in the rail loading area by 98 per cent. This equates to a 10-tonne reduction in styrene emissions from the Sarnia site, a 40 per cent reduction of total site styrene emissions. (CCPA Reducing Emissions 8 Report).

PULP AND PAPER

The pulp and paper sector participates in the ASAP, specifically, the Ontario Forest Industries Association (OFIA). The OFIA represents 17 member companies that operate sawmills, pulp and paper mills, veneer and panelboard mills in more than 35 locations in Ontario.

Through OFIA's Environmental Policy, member companies are committed to principles that prevent or minimize adverse impact on the environment and to employing the most progressive management practices to continually improve environmental performance.

Many companies are active in efforts to reduce emissions that lead to smog and acid rain.

Waste heat recovery and combustion improvement technologies

FOCUS ON NO_x REDUCTIONS FROM BOILERS AND HEATERS

On March 2, 2001, the Ministry of the Environment finalized "Policy guideline A-9: NO_x Emissions from Boilers and Heaters". The guideline enforces the adoption of the National Emissions Guideline for Commercial/Industrial Boilers and Heaters, published in March, 1998 by the Canadian Council of Ministers of the Environment (CCME). The Guideline specifies limits for emissions of NO_x for new, fossil-fuel, boilers and heaters which have a fuel energy input greater than 10 million British thermal units per hour. The Guideline specifies various NO_x emission limits, based on the fuel and the size of boiler/heater, with specified credits for high efficiency. The Guideline applies to modified, existing, large boilers and heaters.

are used to reduce NO_x, VOCs and SO_2, as well as emissions of particulate matter. Control measures for VOCs include switching to water-based coatings from solvent based coatings and incinerating VOC emissions. In future, this sector is considering the use of alternative fuels like natural gas to reduce SO_2 and NO_x emissions.

Control technologies for particulates include use of high pressure venturi scrubbers, dust collectors and multi-clones for power boilers. One company has installed an electrostatic precipitator (ESP) for controlling particulate emissions from biomass fuel boilers.

ELECTRICITY

An ASAP Accord signatory, Ontario Power Generation Inc. (OPG), is a major Ontario-based electricity generator, supplying about 85 per cent of all electricity consumed in Ontario. As of December 31, 2000, the company owned five nuclear generating stations, six fossil-fueled generating stations and 69 hydroelectric stations.

Air pollution from Ontario's power sector is generated almost exclusively from coal or oil/natural gas-fired stations. In Ontario, OPG's six fossil fuel stations account for 14 per cent of Ontario's emissions of NO_x and 24 per cent of SO_2 (1999 data). The electricity sector is a small source of VOCs.

Ontario Power Generation has reduced the average NO_x emission rate from its fossil fuel stations by 22 per cent since 1990 (as of 1999). OPG has production capacity which is currently not operating: 2,060 megawatts at Pickering Nuclear Generating Station and 3,076 megawatts at Bruce-A Nuclear Generating Station. Due to these reductions in nuclear power generation in the province, OPG's fossil fuel plants have increased power production to meet power demands, which has resulted in an increasing NO_x emissions trend from 1995 onwards. To help control NO_x and SO_2 emissions, OPG has undertaken the following initiatives (Ontario Power Generation, OPG Sustainable Development Report):

- increased its use of low-sulphur coal;
- upgraded the low-NO_x burners on all eight units at Nanticoke;
- converted all four units at Lennox to dual-fueling so that natural gas or oil can be used since natural gas has no SO_2 emissions and lower NO_x emissions than oil;
- installed scrubbers in two units at Lambton to reduce flue gas SO_2 content;
- completed combustion process modifications for two units and installed enhanced boiler controls in two units to reduce NO_x emissions; and
- proposed to install four NO_x removal technologies (Selective Catalytic Reduction, SCR) on two units at Lambton and two units at Nanticoke.

In 1991, OPG's predecessor, Ontario Hydro, made a voluntary commitment to limit its net 10NO_x emissions to 38 kilotonnes (as NO; 58.14 kilotonnes as NO_2) a year beginning in 2000. This has become OPG's principal contribution to Ontario's ASAP and represents a 24 per cent reduction from 1990 levels. OPG has also participated in the Pilot Emissions Trading Program (PERT) and has been acquiring NO_x credits to achieve their voluntary NO_x commitment despite the increased use of coal due to the reduction of nuclear power generation.

The Ontario Government has put in place regulations limiting total annual emissions from electricity generating stations in Ontario. In 2002, allowances will be awarded for 36 kilotonnes of NO_x (as NO) per year and 28 kilotonnes per year (as NO) in 2007. Emissions of SO_2 will also be limited

FOCUS ON INDUSTRY POINT SOURCE REDUCTIONS

Table 2.1.1 below provides examples[6] of some of the reductions that have taken place since 1990, and are planned to the year 2015. In some cases, the measure may not result in reductions of NO_x, SO_2, and/or VOCs, or could not be adequately estimated, as indicated by "N/A".

TABLE 2.1.1: SAMPLES OF INDUSTRY POINT SOURCE REDUCTIONS ACHIEVED AND PLANNED SINCE 1990

SUBSECTOR	MEASURE	NO_x		VOCS		SO_2	
		kt	year	kt	year	kt	year
Non Ferrous Smelters	Achieved/Voluntary Reduction	43	1991	N/A	N/A	430	1999
	Proposed/Draft Order[7]*	N/A	N/A	N/A	N/A	65	2006
Electricity	Achieved/OPG Voluntary Reduction	1.5	1999	N/A	N/A	32.6	1999
	Anticipated/OPG Voluntary*	17.2	2000				
	Regulation: Sector NO_x Cap (55.2kt NO_2); SO_2 Cap (157.5kt)*	3	2004				
	Regulation: Sector NO_x Cap (43kt NO_2); SO_2 Cap (131kt)*	14	2007	N/A	N/A	33.1	2007
Boilers/ Heaters	CCME Guideline Implementation*	8	2015	N/A	N/A	NA	N/A
Iron & Steel	Combustion control and improvement*	2.4	1998	1	1998	6.5	1998
	Process changes and new facilities	1.3	1999	1.4	1999	3	1999
	Iron ORE Plant Closure (Wawa)	–	–	–	–	42	1999
Cement	Kilns* - operation improvements	4.2	1999	N/A	N/A	0.7	1999
Chemical	Process changes, LDR, tank controls, energy measures*	3.2	1999	10.6	1999	5.1	1999
	CCPA Responsible Care*	N/A	N/A	2.3	2005	N/A	N/A
Automobile manufacture	Improved efficiency, quality control and solvent management practices	N/A	N/A	11.9	1993	N/A	N/A
	Achievied/Autoparts Manufacturing ASAP Survey Update*	0.2	1998				
		4.5	1999				
Petroleum refinery	Various process changes and controls*	3.2	1999	25.9	1999	5.3	1999
Fuel marketing	Stage 1 vapour recovery MOE reg 1994	N/A	N/A	19	1998	N/A	N/A

by regulation. Allowances will be awarded for 157.5 kilotonnes per year for 2002 and 131 kilotonnes per year for 2007. The limits for OPG's six coal and/or oil-fired plants represents a 53 per cent reduction from the existing NO_x limits on these facilities and a 25 per cent reduction of SO_2.

An incentive system has also been put in place to encourage electricity conservation and electricity generation using zero emissions renewable energy sources.

NON-FERROUS SMELTING

In Ontario, INCO and Falconbridge are two major operators of non-ferrous smelters (nickel, copper and zinc metal recovery from ore/concentrates) and account for over 40 per cent of SO_2 emissions in Ontario. Reductions of SO_2 from these companies are important to meeting Ontario's SO_2 reduction goals.

Both INCO and Falconbridge are signatories to the Anti-Smog Accord. Since 1990, the sector's NO_x emissions have declined significantly from 1990 levels. This reduction in NO_x emissions resulted from the modernization of smelting technologies by INCO and Falconbridge, which almost eliminated the use of fossil fuel in smelting operations.

Through Ontario's Countdown Acid Rain Program, initiated in 1985, INCO and Falconbridge have been committed to achieving annual SO_2 emissions limits of 265 kilotonnes and 100 kilotonnes, respectively, by 1994. Significant reductions have been achieved by both companies due to increased rejection of sulphur during mineral concentration operations (ore and concentrate treatment) and capturing SO_2 emissions from smelting processes in acid plants which convert SO_2 to sulphuric acid, a usable product by many chemical industries. INCO has reported that during the past decade, local air quality in the Sudbury area has steadily improved because of reductions in SO_2, process changes in smelter and refineries and refinements to the Emission Reduction Program (ERP) in the Ontario Division. Between 1990 and 1999, non-ferrous smelters' SO_2 emissions have decreased by 62 per cent.

In January 2000, Ontario established a target of reducing SO_2 emissions by 50 per cent beyond the 1994 limits (to 442 kilotonnes),

[6] These examples of reduction initiatives have been reported by ASAP partners without accounting for growth in emissions and are therefore not indicative of total emissions reductions. The reductions anticipated to be achieved are only estimates based on the modelling estimation methods used. Section 3.0 provides further insight as to the trend in emissions levels since 1990 and the range of reductions that may be achieved in the future, depending on various modelling estimates.

[7] The asterisks indicate that the initiative is new since the last progress report, or that data have been updated through the survey of ASAP partners. For details on these updates, please refer to the Table 2.1.1 notes in the appendix.

by 2015. As part of this Canada-Wide Acid Rain Strategy for Post-2000, on September 11, 2001, the ministry issued proposed Director's Orders for INCO and Falconbridge that would require both companies to reduce annual SO_2 emissions by a further 34 per cent from their current regulated SO_2 emission levels by December 31, 2006. The allowable ground level concentration of SO_2 is to be reduced from 0.5 ppm to 0.34 ppm by April 1, 2002. The orders were finalized on February 12, 2002.

AREA SOURCES

GENERAL SOLVENTS

This sector is comprised of a large number of small and medium-sized companies which collectively contribute 22 per cent of Ontario's VOC emissions. Commercial/industrial printing facilities that use volatile solvents in inks, adhesives and sealants, manufacturing, plastics processing, household products and windshield washers are just some of the operations that make up this sector. There are a number of companies within this sector that have signed the Anti-Smog Accord.

Printing and Graphics

Quebecor Printing Canada and Shorewood Packagers, two of the sector's ASAP Accord signatories, along with the Printing and Graphics Association have been collaborating with Environment Canada and the Ministry of the Environment on a Memorandum of Understanding (MOU)to undertake a Pollution Prevention Project (Environment Canada, Printing and Graphics Industry Pollution Prevention Project). Under this MOU, participants in the lithographic and paper printing sector have agreed to continue to: promote pollution prevention practices and environmental management systems among all printing and graphics companies, continue to develop and promote education and training tools for pollution prevention, actively pursue VOC emission inventories and reduction initiatives as part of pollution prevention plans, and look at opportunities for energy conservation as part of their environmental management plans. Total reductions of VOCs achieved through this initiative are approximately 400 tonnes per year.

This sector is also working to encourage the implementation of the CCME Environmental Code of Practice for the Reduction of Volatile Organic Compound Emissions from the Commercial/Industrial Printing Industry, published in August 1999. Full implementation would affect up to 100 companies.

Plastics Processing

Printing on plastics represents a significant source of VOC emissions in Ontario. Ink solvents amount to approximately 19 kilotonnes of VOC emissions. The Canadian Plastics Industry Association (CPIA), an Anti-Smog Accord signatory remains a key partner in developing reduction initiatives. A study is underway to examine the cost of implementing control technologies and other initiatives outlined in the CCME Code of Practice (Canadian Plastics Industry Association, Plastics and the Environment).

Adhesives and Sealants

This sector covers the manufacture of adhesives that are applied in woodworking, industrial manufacturing, metal fabrication and packaging and labeling. The Adhesives and Sealants Manufacturers Association of Canada (ASMAC), an ASAP Accord signatory, has undertaken an analysis of product substitution programs that are aimed at moving away from solvent-emitting products. For instance, shifting to water-based formulations and decreasing the amount of solvent by increasing the solids content or moving to hot-melt adhesives, which contain no solvents are possible product re-formulations that could help reduce VOC emissions.

SURFACE COATINGS

Surface coatings are used in a wide range of manufacturing activities including automobile manufacturing, automobile refinishing, automotive parts, wood products, architectural and maintenance coatings, can coating, metal packaging, and general metal finishing. This sector accounts for about 10 per cent of Ontario's total VOC emissions. A number of companies within this sector are active in the ASAP and are Accord signatories.

Auto Manufacturing

The Canadian Vehicle Manufacturers' Association (CVMA) members who operate facilities in Ontario include Daimler-Chrysler Canada Inc., Ford Motor Company of Canada Limited, and General Motors of Canada Limited. CVMA members, in spite of increases in production levels between 1993 to 1999, have achieved a 32 per cent reduction in VOC emissions (from 1993 levels) as a result of equipment upgrades, process modifications, material substitution and effective environmental management systems. This is part of the ongoing effort to reduce VOC emissions from surface coating operations.

In addition, since 1992, the Canadian Automotive Manufacturing Pollution Prevention Project has been a voluntary effort of member companies of CVMA, Environment Canada and the Ontario Ministry of the

FOCUS ON DAIMLER CHRYSLER

The Brampton Assembly Plant (previously called the Bramalea Assembly Plant) located in Brampton, Ontario, manufactures 1,377 cars per day of the LH line - Chrysler Intrepid, Concorde, 300M and LHS. The production processes include stamping, body welding, painting and assembly. In the past, vehicles in the plant were painted with a solvent-based colour coat prior to spraying with a solvent-borne clear coat. During the summer of 1997, the Bramalea Assembly Plant converted the colour base coat paints from high-solids solvent borne enamels to waterborne paints. This conversion reduced solvents in the base coat painting by 75per cent, with specific reductions of 14 tonnes of methanol, 70 tonnes of MEK, two tonnes of MIBK, four tonnes of toluene, 28 tonnes of xylene, and 25 tonnes of other VOCs. Total capital investment for this pollution prevention project was approximately $57 million. T his case study is from the Fifth Progress Report from the CVMA P2 Project. The Sixth and Seventh progress reports highlight other VOC reductions that have taken place (the Sixth Progress report can be found at the Environment Canada's Web site and the Seventh report from CVMA's Web site at www.cvma.ca).

FOCUS ON PAINT AND COATINGS BY CPCA

The Canadian Paint and Coatings Association (CPCA) includes companies that manufacture consumer paints, industrial coatings, and automotive coatings. CPCA companies are shifting from solvent-based technologies to water-based technologies and the widespread use of latex paints containing lower levels of VOCs. CPCA companies launched Coatings Care, an environmental program defining the exact responsibility of paint manufacturers, distributors and suppliers, as well as retailers and consumers, when making decisions about paint that affect the environment. "The Environment Reduction Plan for Nitrogen Oxides/Volatile Organic Compounds, published by CCME in 1988, set a target to reduce VOCs in consumer paints by 20 per cent over 12 years, between 1985 and 1997. An independent study conducted by the Ontario Research Council in 1991 showed that VOCs from consumer paint in Canada had already dropped substantially after only six years. To ensure that details on this continuing decrease were identified, the Association agreed to gather information on the VOC content of all consumer paints sold in Canada and provide aggregate results to the other parties. The first report, presented to Environment Canada and the CCME covered the period from 1991 to 1995 and showed a further 20.1 per cent reduction in VOCs from consumer paints. A further reduction of 27 per cent VOC emissions from these products was identified in 1998.

Environment. As part of this agreement, VOC emission reductions have been reported. The Seventh Progress Report indicates reduction of more than 5,000 tonnes VOCs per year.

With respect to automotive manufacturing operations, the five automotive companies in Ontario, CVMA and the Ministry of the Environment have drafted a MOU to meet the CCME "New Source Performance Standards and Guidelines for Reduction of Volatile Organic Emissions from Canadian Automotive OEM Coatings Facilities" by 2005 (CCME, October 1995). The assembly operations have been continuing efforts to meet this objective since 1999 while details on the agreement are being reviewed. The automotive companies and CVMA are awaiting discussions with the Ministry to implement an agreement to meet the CCME "New Source Performance Standards and Guidelines for the Reduction of Volatile Organic Compound Emissions from Canadian Auto OEM Coating Facilities". The automotive companies continue to seek out further improvements to reduce VOC emissions from automotive coating operations.

Automotive Refinishing

This sector includes the repainting of vehicles for repair and appearance. The Hamilton District Autobody Repair Association (HARA) is the largest local collision repair and auto finish trade association in Canada. The association has been actively involved in a range of environmental programs including the development of national auto refinish national standards and guidelines, informational activities, updating training sessions for industry

FOCUS ON MANUFACTURING VOC EMISSIONS REDUCTIONS

The table provides a sample of emission reductions by ASAP partners from "area sources" which encompass residential and commercial buildings and small industrial sources.

TABLE 2.1.2: SAMPLES OF INDUSTRY/MANUFACTURING AREA SOURCE VOC REDUCTIONS ACHIEVED AND PLANNED SINCE 1990

SUBSECTOR	MEASURE	VOCS	
		kt	year
Printing and Graphics	CCME code for the printing industry	0.4	2000
General Solvents	Consumer Coating: Product reformulation	3.8	1995
	Adhesives & Sealants: Reductions in solvent use; switch to water-based product	1.6	1995
	Wood Treatments: Reduced use of oilborne preservatives	0.6	2015
	Rubber Products: Efficiency measures	1.2	2015
	Plastic Processing:Efficiency measures	0.3	1997
	Consumer Products: Adoption of US rules for solvent content	5	2015
Surface Coatings	Auto Refinishing: GTA body shop accreditation program	0.5	1996
	Spray Guns: Use of high-efficiency spray guns and low-solvent coating	3	2000
	General Metal Improved formulation	0.1	1998
	Can Coating	0.5	1998
	Furniture Manufacturing - Metals	0.1	1998
	Furniture Manufacturing	0.12	1998

managers and owner/operators, and finalizing a self-management environmental compliance program between industry and government. The latter program involves a requirement for facilities to meet or exceed the environmental standards as mandated by the province. HARA and its shop members have won numerous awards for their work including the Ontario Pollution Prevention Leadership Award, the Canadian Healthy Environment Award, the Ontario Small Business Pollution Prevention Award, the Recycling Council of Ontario's Committee Award and numerous regional and municipal awards.

Automotive Parts

The sector has been working with the Ministry of the Environment to develop an MOU. The Automotive Parts Manufacturers' Association (APMA) has about 200 members and 400 facilities. Currently, work is underway to survey members to determine baseline emissions levels before establishing objectives for reductions in this sector. A draft CCME standard for spray paint is also being developed that may apply to member companies.

2.2 TRANSPORTATION

In Ontario, transportation is the largest single source of smog-related pollutants. Transportation sources include cars or passenger vehicles ("light-duty vehicles") and freight (trucks or "heavy duty vehicles"). They also include off-road diesel vehicles and engines such as locomotives and tractors; gasoline-powered utility engines such as those used in snowblowers, lawn mowers, chain saws; and outboard marine engines and personal watercraft.

In 1999, transportation sources, including off-road vehicles, contributed to about 64 per cent of the NOx and 30 per cent of emissions of VOCs in Ontario. Vehicles also contributed approximately six per cent of the province's SO2 emissions. Smog reduction initiatives in the transportation sector will be critical to ensuring a 45 per cent reduction of NOx and VOCs emissions from 1990 levels by the year 2010 (current proposal) or 2015.

The next section highlights activities of ASAP partners from the transportation sector who are focused on engine technology and cleaner fuels for off and on-road motors. Transportation sector partners include the CVMA, CPPI, the Ontario Trucking Association (OTA), and all levels of government.

ON-ROAD VEHICLES - AUTOMOBILES, LIGHT DUTY TRUCKS AND HEAVY DUTY TRUCKS

CLEAN VEHICLE INITIATIVES

The automobile industry has made significant contributions to the reduction of emissions from on-road mobile sources. Advanced emissions controls systems on today's vehicles are capable of removing from 90 to 96 per cent of emissions compared to 1970s vehicles with the appropriate fuels available in the marketplace.

Ontario benefits from these technologies.

As part of the federal agenda on Cleaner Vehicles and Fuels, in February 2001, Environment Canada announced intentions to align new Canadian emission standards for vehicles and engines with those of the United States Environmental Protection Agency. Regulations under the Canadian Environmental Protection Act will be developed to reduce emissions from cars, vans, pick-up trucks and sports utility vehicles and will be phased-in beginning with the 2004 model year ("Tier 2" vehicle standards). As well, the development of a Code of Practice for Heavy Duty Vehicle Inspection and Maintenance programs by the CCME is nearly complete. This will allow provinces to initiate or upgrade programs that will monitor emissions from large trucks and buses.

The automobile industry as a whole has undertaken several initiatives to help reduce emissions from new light duty vehicles including the phase-in of enhanced evaporative emissions control systems and on-board diagnostics, extended durability, fuel spitback, refuelling vapour recovery system, etc., on a harmonized basis with the United States beginning with the 1998 model year. The CVMA signed a Letter of Cooperation under ASAP and has reported considerable progress.

In June 2001, the Canadian Vehicle Manufacturers Association along with the Association of International Automobile Manufacturers of Canada entered into a Memorandum of Understanding with Environment Canada to commit to selling the same low-emission vehicles in Canada that will be marketed in the United States under the Voluntary National Low-Emission Vehicle program for the 2001 to 2003 model years. Low-emission vehicles exceed the emission

FOCUS ON CLEANER FUELS

- On June 23, 1999, Environment Canada Gazetted the final regulation on sulphur levels in gasoline. A maximum annual average level of 30 parts per million is required as of January 1, 2005, with a phase-in between July 1, 2002 and December 31, 2004, where the average level over that period cannot exceed 150 parts per million.

- In December 2001, Environment Canada proposed a diesel fuel regulation that would reduce on road diesel fuel to 15 parts per million (ppm) effective June 1, 2006. In January 1998, sulphur levels in diesel fuel were reduced from the maximum amount of 5,000 ppm to a maximum amount of 500 parts per million. The proposed regulation will reduce the sulphur content of diesel fuel by more than 95 per cent relative to the current sulphur limit of 500 ppm.

- On July 1, 1999, the Benzene in Gasoline regulation came into effect, requiring a 40 per cent reduction in average benzene content in gasoline sold in Canada.

- The reduction of vapours through provisions of the Gasoline Blend Dispensing Flow Rate Regulation, introduced in February 2000 by the federal government, is helping to control vehicle refuelling emissions, especially of VOCs, as is the Stage 1 Vapour Recovery regulation introduced in the mid-90s by Ontario.

- On October 24, 2001, Ontario announced that it would review its existing regulations limiting sulphur content in fuel oil and coal with a view to reducing the allowable levels of sulphur in these fuels (Regulation 338) and expanding the geographical areas (Regulation 361). Ontario Regulation 338 limits the sulphur content in fuels used in boilers that have been installed or modified since 1986 to one per cent by weight (excluding electric generating station boilers and those used for comfort heating in homes housing no more than three families). Regulation 338 allows the use of high sulphur content fuels in boilers only if pollution control equipment is used to limit emissions to the equivalent of one per cent by weight. Ontario Regulation 361 limits the sulphur content of fuels used in all types of equipment for the Toronto area. Fuel suppliers are required to limit sulphur in fuels as follows: Fuel Oils No. one and two - limit of 0.5 per cent sulphur content by weight; and Fuel Oils No. four to six plus bituminous coal - limit of 1.5 per cent sulphur content by weight.

performance requirements of current regulations and have the potential to reduce smog-forming exhaust emissions of hydrocarbons and oxides of nitrogen by about 99 per cent and 95 per cent, respectively, relative to uncontrolled levels.

The Ontario Trucking Association (OTA) has also reported that major strides are being made in reducing smog-causing emissions from trucks. Truck diesel engine emission levels have decreased dramatically over the last 20 years. Compared to engines produced before 1989, today's on-highway truck engines reduce PM emissions by 83 per cent and NO_x emissions by 63 per cent. Environment Canada has proposed emissions standards for heavy duty vehicle engines that align with the U.S., which will achieve significant reductions of NO_x and particulate matter emissions.

Other efforts made by the trucking industry have been focussed on improved energy efficiency. According to a recent federal government report, the trucking industry is leading the way in energy efficiency among freight transportation modes. The report, titled *"Energy Efficiency Trends in Canada 1990 to 1999"*, was prepared by the Office of Energy Efficiency and released in July 2001 by Natural Resources Canada (NRC). Fuel efficiency improvement attained by the trucking industry has had the equivalent impact of removing 50,000 heavy trucks (13 per cent of the heavy truck population) from Canadian roads and has been attributed to the industry's ability to consolidate loads, increase backhaul movements and improve industry practices like maintenance, vehicle specification and driver skills.

Emission reduction opportunities through more stringent vehicle standards may only be realized if the proper fuels are in place so that the emissions control technologies operate as designed. The following section discusses the efforts that are being made by many ASAP participants to provide cleaner fuels.

FOCUS ON TRANSPORTATION SECTOR EMISSIONS REDUCTIONS

Table 2. 2.1 below provides examples of initiatives that have led to reductions of NO_x emissions in Ontario or are planned for the future (for more information on these estimates please refer to notes in Appendix). These emission reduction estimates are based on the Ministry of the Environment's modelling work ("Mobile 5C"). For a more comprehensive discussion on future reductions anticipated from the transportation sector, please refer to Section 3, "Approach to Estimating Future Emissions".

TABLE 2.2.1: SAMPLING OF TRANSPORTATION REDUCTIONS ACHIEVED AND PLANNED SINCE 1990

SUBSECTOR	MEASURE	NO_x		VOCS		SO_2	
		kt	year	kt	year	kt	year
LDGV/HDGV	Tier 1 Standards / RVP / Drive Clean[8]*	49	1995	62	1995	N/A	N/A
		36	1999	34	1999		
	NLEV/ Tier 2 Standards and Low Sulphur Gasoline (30 ppm) Regulation	47	2000-2015	75	2000-2015	7	2015
LDDV/HDDT	Low Sulphur Diesel (15 ppm) Environment Canada Reg.	18	2000	1	2000	12	2000
	Heavy Duty Engine Standards and Low Sulphur Diesel (15 ppm) Environment Canada Reg.	39	2006-2015	1	2000 2015	N/A	N/A
Vehicles	Alternative fuel*	6	2015	3	2015	N/A	N/A

CLEAN FUEL INITIATIVES

High levels of sulphur in gasoline lead to pollution in two ways: 1) emissions of sulphur dioxide and sulphates contribute to particulate matter and acid rain; and 2) increased vehicle emissions of NO_x and VOCs. CPPI members have been focusing their anti-smog efforts on producing cleaner fuels for cars and trucks that meet sulphur content regulations and other voluntary actions. Working with governments and other stakeholders, CPPI's fuel quality improvements are linked to the advanced vehicle emissions control technology that will be needed to achieve more stringent emission standards.

Since the last ASAP progress report, CPPI has been active in a number of fuel quality related fronts, including the reduction of sulphur levels in gasoline and diesel to meet the federal regulatory requirements, a benzene in gasoline reduction program and limiting gasoline dispensing rates (see "Focus on Cleaner Fuels").

[8] The asterisks indicate that the initiative is new since the last progress report, or that data have been updated through the survey of ASAP partners. For details on these updates, please refer to Table 2.2.1 notes in the appendix.

INSPECTION AND MAINTENANCE PROGRAM

The Ministry of the Environment's Drive Clean Program is a comprehensive vehicle inspection and maintenance program designed to ensure that emissions from on-road vehicles (primarily cars and light duty trucks) remain within acceptable limits. This program is crucial to improving the operation of existing fleets of vehicles while stricter emissions standards for new fleets are being developed. Gross emitters will be required to be repaired, or retired.

Drive Clean emissions testing became a mandatory part of the vehicle registration renewal process in the GTA and Hamilton-Wentworth on April 1, 1999. The program also assists with educating the public about the need for proper maintenance of vehicles.

In January 2001, Ontario's Drive Clean program officially expanded into its Phase 2 area which includes 13 more urban centres and their commuting zones, covering the area from Peterborough to Sarnia and the Niagara Region. Drive Clean facilities have tested about 2.5 million light-duty vehicles and 200,000 heavy-duty trucks and buses since 1999. In the first two years (1999-2000) of the program, Drive Clean reduced smog-causing vehicle emissions by 11.5 per cent in the in the Toronto and Hamilton areas.

The Drive Clean program will expand again on July 1, 2002 to include the entire southern Ontario smog zone which will include a total of approximately 5.7 million vehicles.

SMOG PATROL

Ontario's Smog Patrol is the on-road enforcement component of Drive Clean, designed to spot-check trucks, buses and light duty vehicles that are gross emitters of smog-causing pollutants. Introduced in 1998, Smog Patrol units identify vehicles emitting visible smoke on Ontario roadways. Heavy polluting vehicles are stopped, inspected and, if necessary, escorted to a mobile test facility. Smog Patrol officers also check vehicles to ensure that emissions control equipment is in place and has not been altered. In the year 2000, approximately 2,000 light duty vehicles and 592 heavy-duty vehicles had been inspected by Smog Patrol.

REDUCING VEHICLE TRAFFIC

Transportation Demand Management (TDM) is a comprehensive strategy to modify travel demand in ways that reduce the number of vehicles in service and total distance travelled. The principal objective of TDM is to support, where movement of people or goods is necessary, a shift from single occupancy automobile use to other modes of transportation, particularly transit, carpooling, walking and cycling. The City of Toronto and many non-government organizations are leading the way in TDM. For example, the City of Toronto, the Toronto Transit Commission (TTC) and GO Transit are involved in a number of projects aimed at reducing the effects of transportation sources on the City's air quality. TTC undertakes initiatives to encourage higher transit use, including advertising campaigns and customer information (through Web site, telephone and printed materials). Incentives include the Metropass Discount Plan and Day Pass promotions during March Break. Furthermore, all vehicles operated by TTC and GO Transit are tested to be compliant with Ontario's Drive Clean Program, and low-sulphur diesel fuel is used during the summer smog months.

OFF-ROAD ENGINES

Since 1990, NO_x and VOC emissions from off-road engines have increased by over 20 and 10 kilo-tonnes, respectively. In 1999, this source accounted for approximately 20 per cent of Ontario's emissions of NO_x. The federal government has been undertaking efforts to improve the design and manufacturing of off-road engines by aligning future off-road standards with those of the U.S. EPA. To date, the federal government has entered into a number of voluntary agreements with manufacturers of outboard engines and personal watercraft, small handheld and non-handheld utility engines, and off-road diesel engines. These agreements seek the early introduction of the applicable classes of off-road engines designed to comply with the first stage of stringent U.S. federal emissions standards.

In addition, as part of its Agenda on Cleaner Vehicles, Engines and Fuels (February 2001), Environment Canada intends to develop emission control programs for off-road engines that align with the corresponding U.S. federal emission control programs. These include:

- development of proposed regulations corresponding to the U.S. EPA Phase 2 program for spark-ignition gasoline utility engines (these include small gasoline powered utility engines such as those used in lawn and garden equipment, pumps, generators and handheld equipment). In the U.S., the EPA has estimated that the implementation of Phase 2 standards for small spark-ignition engines will reduce NO_x by an additional 70 per cent beyond the 32 per cent reductions expected from Phase 1 standards;

- development of proposed regulations corresponding to U.S. EPA Tier 2 program for compression-ignition off-road engines (typical engines in this category include diesel engines used in land-based applications as well as marine engines rated below 37 kilo-watts, (i.e., engines

used to power construction, agricultural and forestry equipment as well as industrial equipment such as cranes and generators); and

- development of proposed regulations corresponding to the U.S. EPA program for spark-ignition marine engines.

Environment Canada will also consider the development of a Tier 3 program for compression-ignition off-road engines when the full scope of the U.S. EPA program is available. The federal government also intends to develop emission control programs for large spark-ignition engines, recreation vehicles using gasoline engines, and stern drive and inboard gasoline-powered marine engines once these programs are finalized in the U.S.

2.3 Progress by Government Partners

MUNICIPALITIES

CITY OF TORONTO

In 1997, Toronto City Council established an Anti-Smog Working Group to identify actions the City could take to reduce its own smog-producing emissions, as well as ways in which Toronto could work in partnership with businesses, environmental groups and individuals to reduce emissions across the city. In May 2000, the City's Public Health department released "*Air Pollution Burden of Illness in Toronto*", a detailed analysis of how air pollutants affect the health of Torontonians. The City has initiated a number of actions to reduce smog.

City of Toronto Corporate Smog Alert Response Program

The City's Corporate Smog Alert Response Program was implemented in June 1998. The purpose of the program is to encourage staff to reduce or suspend activities that contribute to poor air quality on days when a Smog Advisory has been issued. A major focus is providing education materials to staff serving risk groups such as children and seniors about smog, its effects on health and the precautions they should take on such days. Special actions that city departments are encouraged to take include reducing the use of non-essential gasoline and diesel powered vehicles; minimizing vehicle idling; reducing the use of oil-based paints, solvents and cleaners; postponing the use of gasoline powered equipment; suspending the use of pesticides; and postponing refuelling of vehicles until dark.

City By-laws

The City of Toronto passed two by-laws for the purpose of reducing emissions of pollutants within its jurisdiction. The Anti-Idling by-law in general prohibits the idling of motor vehicles, including boats in the harbour, for more than three minutes in any one hour. The second by-law prohibits the burning of used motor oil in place of regular heating oil and also prohibits such burning as a means of disposal.

20/20: The Way to Clean Air

This social marketing campaign was developed by Toronto Public Health in 1999, in cooperation with a wide range of partners including GTA municipalities, the Ministry of the Environment, Environment Canada, Toronto Atmospheric Fund, GO Transit and Enbridge Consumers Gas. The campaign focuses on two key behavioural areas that are major contributors to climate change and air quality – transportation and energy use. The objectives of this campaign are to reduce vehicle kilometres travelled (VKT) and home energy consumption by 20 percent across the GTA by the year 2020.

Community Education and Outreach

Toronto Public Health has created new educational materials including, *The Air You Breathe: Smog and Your Health*, to raise public awareness about air pollution and its effects on health. In addition, Public Health distributed a report, *Toronto's Air: Let's Make it Healthy*, across the community including libraries, high schools and universities/colleges. It describes the air pollutants in Toronto and recommends ways to improve Toronto's air. *Moving Towards Cleaner Air* is the most recent progress report on Toronto's air quality strategy.

Toronto Public Health is also working with partners such as the Toronto District School Board and the Toronto Regional Conservation Authority to educate youth about air quality actions. As part of the program, volunteers receive 40 hours of training followed by 40 hours of monitored grass roots outreach in the Toronto community.

Municipal Air Quality Modelling

Toronto's Works and Emergency Services Department has established the capability to model local air quality in and around the City of Toronto. Through modelling, the Department identifies local air quality conditions, trends and trouble spots. The results are then used to predict impacts of infrastructure changes on air quality, develop policy and specific measures to improve air quality, as well as improve measures and verify their effectiveness.

Regional Municipality of Hamilton - Wentworth

Clean Air Hamilton has adopted the Smog Alert Response Program and is taking steps to implement its own "Community Smog Plan". Hamilton's plan incorporates a Smog Response Plan to advise the public on days when the Air Quality Index (AQI) is at 50 or greater. It includes a list of policies that the city follows on Smog

Advisory Days as well as a management strategy that describes the actions to be taken to reduce smog levels over the long term. The City of Hamilton, in collaboration with Clean Air Hamilton, has also developed a Clean Air Award as part of the Sustainable Community Awards. Any individuals, groups or organizations that are working to keep Hamilton's air clean can be nominated for the award. Hamilton has also taken action to inform and educate the public about the impacts of smog, such as the November 2000 seminar at the Hamilton Central Public Library on the findings of the study "*Air Pollution Burden of Illness in Toronto*".

Finally, the city has formed an "Emissions Reduction Working Group" that identifies and evaluates opportunities for reducing emissions, such as vehicle partnerships, a commuter challenge, street sweeping, anti-idling signs, and improved land use planning.

Regional Municipality of Peel

Many different types of initiatives are taking place in Peel Region, ranging from policy-based initiatives to grassroots community projects. The Regional Official Plan and the official plans of the local municipalities contain policies designed to promote monitoring of air quality, increased use and support of public transportation, protection of important natural areas, and rehabilitation of degraded ecosystems.

In an effort to raise awareness, the Region is currently updating their *State of the Environment Atmosphere Report (1995)* in order to provide residents and decision makers with the latest information on the quality of Peel's air and issues of concern. To improve air quality monitoring in the Region, efforts are being made to have an AQI station located in the City of Brampton.

ONTARIO'S MINISTRY OF THE ENVIRONMENT

The Ministry of the Environment has announced several new smog-reducing initiatives since 1999, and continues to make progress on expanding past programs. Initiatives involving ASAP stakeholders are highlighted.

Emissions Caps and Emissions Reduction Trading for the Electricity Sector

On January 24, 2000, Ontario proposed an emissions reduction trading system to allow generators flexibility to achieve reductions of NO_x and SO_2 more cost effectively and expeditiously. By March 2001, a discussion paper on the proposed system and emissions limits (caps) was released for public and stakeholder comment and on July 31, 2001 the Ministry posted the draft emission trading regulation, its accompanying Code and a technical description, to the Environmental Registry. The emissions caps and trading system became law on January 1, 2002. Under the system, an emissions limit is set for the electricity sector, divided up among participating power plants, with each company receiving a so-called emissions allowance either annually or for a defined period. In order to keep emissions within their allowances, generating stations may choose to install pollution control equipment, switch to cleaner fuels, improve their energy efficiency, or decide to buy or retire credits.

On October 24, 2001, the Ontario Government announced decisions on a number of further air quality measures. Actions include:

- The finalization of the Lakeview regulation, specifying that the plant cease burning coal by April 2005. Emissions from the plant after April 2005 must meet or exceed the emissions performance of a natural gas-fired electricity generating station.
- The finalization of the Emissions Reduction Trading (ERT) regulation, setting tough emission limits for NO_x and SO_2 from the electricity sector and defining the rules for an emissions reduction trading system to assist industries to cost-effectively reduce smog and acid rain-causing emissions. The NO_x emission limit of 28 kilotonnes NO_x (expressed as NO) for 2007 is partitioned with 17 kilotonnes (NO) going to the six facilities currently owned by OPG and 10 kilotonnes (NO) for other power stations referred to as Independent Power Producers (IPPs). One kilotonne of the NO_x cap is set aside to encourage renewable energy projects and energy conservation activities. The SO_2 limit of 131 kilotonnes (127 kilotonnes with 4 kilotonnes 'set aside' for energy conservation efforts) represents a 25 per cent reduction from the existing SO_2 cap set under the Countdown Acid Rain program (the 175 kilotonne Countdown cap has been in place since 1994).
- A proposal to advance the NO_x and SO_2 reduction target date to 2010, from 2015, to meet the Canada Wide Standards for $PM_{2.5}$ and ozone. This proposal was posted to the Environmental Bill of Rights Registry on October 24, 2001, for a 90 day comment period.
- A proposal to initiate consultation with industrial and other stakeholders on setting limits for NO_x and SO_2 emissions for other major industrial emitters. This proposal was also posted to the Environmental Registry for a 90 day comment period on October 24, 2001.
- A proposal to review Ontario's existing regulations governing sulphur levels in fuel oil and coal.

• A proposal to consult on a plan to reduce VOC emissions from industry sources.

Update to the Environmental Assessment Process for the Electricity Sector

To further ensure that the environment is protected in Ontario's competitive electricity market, Ontario also modified the Environmental Assessment Act (EAA) requirements for new electricity projects, which now apply equally to public and private sector projects. The new requirements under Ontario Regulation 116/01 to the *Environmental Assessment Act* distinguish between three project categories ranging from those with relatively benign environmental impacts to those with known and significant environmental effects. The latter category would be subject to individual environmental assessments. The environmental assessment requirements on private sector electricity projects focus on projects that are most likely to have significant environmental effects while allowing small projects with minor environmental effects to be addressed through other approval processes. These requirements also provide a level playing field for all electricity providers in anticipation of Ontario's competitive electricity market.

Mandatory Monitoring and Reporting

Accurate and timely public reporting of air emissions by all industry sectors is important to facilitate emissions reduction trading and smog reduction. On May 1, 2000, the Ontario Government implemented a regulation (Regulation 227/00) requiring the electricity sector to monitor and report on 28 criteria air pollutants of concern including SO_2, NO_x, and CO_2. Ontario promulgated Regulation 127/01 in 2001 to extend the monitoring and reporting requirements to include 358 substances, and to cover industrial, institutional, commercial and municipal sectors. The regulation makes Ontario the first jurisdiction in the world to require reporting of a full range of greenhouse gas emissions and pollutants that cause smog and acid rain.

In January 2001, a working group was established for consultation on the implementation of the new mandatory monitoring and reporting regulation. The forum is referred to as the "OnAIR Stakeholders Working Group". The working group keeps ASAP members apprised of issues and developments related to the guideline review, sector training and legislative interpretation of the regulation.

Smog Advisories and Smog Watches

The Ministry of the Environment monitors, analyzes and forecasts ambient air quality through the Provincial Air Monitoring Network. In 2000, the ministry began issuing smog advisories as part of the Air Quality Ontario initiative to provide more timely information to the public when high smog conditions are expected. As of May 1, 2000, the ministry began to provide earlier, more effective notification of air quality through a new two-level system. A smog watch is issued when there is at least a 50 per cent probability that smog conditions will occur within the next three days. A smog advisory is issued when there is a high probability of a smog day occurring within the next 24 hours. When levels of ground level ozone are found or expected to be unacceptably high, the ministry issues official smog news releases through the media to enable the public to take appropriate health precautions and to warn major polluters to reduce smog-causing emissions. The public may also sign up to have smog advisories and watches e-mailed to them directly from the ministry. When the weather changes and the air clears, the ministry issues an advisory termination notice.

Smog Alert Response Program

In the Spring of 2000, the Ministry developed a Smog Alert Response Program to provide direction to municipalities, industry and the general public to achieve proactive and reactive responses to smog watches or smog advisories. The Pilot Phase of the Smog Alert Response Program has resulted in the implementation of the program in 10 municipalities, and all Ontario government ministries. Participating locally are the municipalities of Windsor and Essex, Mississauga, Toronto, Hamilton and the Town of Markham. Regional Municipalities include London, the County of Lambton, Halton Region, the Region of Niagara, and the Region of Waterloo. Twenty companies are also participating and the program has been endorsed by NGOs including Toronto Environmental Alliance, Pollution Probe, and the Ontario Lung Association.

Smog Alert Materials

Building of capacity for municipalities and other organizations to coordinate their own Smog Alert Response Program is critical to widespread adoption and successful local action. The Ministry of the Environment has released a Municipal Response Guide and distributes a Smog Alert Response Kit to provide municipalities with guidelines on how to put local smog response programs in place.

The ministry is also continuing the Partners in Air Program, a partnership of high schools, governments, businesses and industry. The program has three components: in-class activities, including instruction, lab experiments, resource materials and projects; monitoring for ozone, particulate matter, sulphur dioxide and other smog precursors; and a Web site for on-line sharing of

information. Province-wide results are posted for students on the Partners in Air Web site at www.partnersinair.org.

ONTARIO'S MINISTRY OF TRANSPORTATION

As a participant in the ASAP, the Ministry of Transportation has continued their involvement in a number of transportation initiatives that are geared towards improving Ontario's air quality.

Public Transportation Initiatives and Smart Growth

On September 27 2001, the Premier of Ontario announced a 10-year, $9 billion plan to ensure the Ontario's transit system helps to strengthen the economy and protect the environment. The new investment plan is made up of Ontario's commitment - $3 billion funding in investments to renew and expand transit, conditional on matching contributions from municipalities and the federal government. As part of this strategy, Ontario committed to cost-sharing up to one-third of municipal transit fleet replacement costs, and to take back responsibility for GO Transit beginning January 1, 2002.

On December 20, 2001, the Ministry of Finance and SuperBuild announced the launch of Phase I of Transit Investment Partnerships (TIP). TIP will provide up to $250 million over 10 years for major transit expansion projects in urban areas outside of the Golden Horseshoe Region. The purpose of the SuperBuild TIP Fund is to facilitate strategic transit expansion that will contribute to Smart Growth and improve the quality of life in Ontario. Investments under TIP will be awarded to projects that, for example, provide solutions to inter-regional and region-wide congestion and growth pressures; position transit as an attractive and financially viable alternative to automobile use; and expand transit ridership and achieve a significant automobile-to-transit modal shift in key commuter transportation markets; and, integrate transportation infrastructure planning with land use development strategies.

A Golden Horseshoe Transit Investment Partnership (GTIP) was also announced, providing up to $1.25 billion over 10 years for inter-regional transit projects in the Golden Horseshoe region. The purpose of SuperBuild GTIP is to help alleviate congestion and gridlock in the Golden Horseshoe Region.

ENVIRONMENT CANADA

Environment Canada's commitments and actions to reducing smog are highlighted below. Their programs have been the focus of discussions by the ASAP forum.

Ozone Annex

The Ozone Annex to the Canada-US Air Quality Agreement was signed at the Canadian Embassy in Washington on December 7, 2000 by Federal Environment Minister David Anderson and Frank Loy, U.S. Under-Secretary of State for Global Affairs. The 1991 Canada-U.S. Air Quality Agreement initially focused on acid rain issues - the Annex marked a significant step toward addressing transboundary air issues and an opportunity for the Province of Ontario and federal government to work collaboratively on negotiating an effective strategy to control transboundary smog emissions.

The federal government has jurisdiction over issues regarding transboundary pollution. However, the Ontario Ministry of the Environment played a key role as a member of the Canada-US Air Quality Committee that provided advice and technical expertise in the development of a federal position on smog reduction commitments. The resulting Ozone Annex contains

FOCUS ON THE OZONE ANNEX COMMITMENTS

- Aggressive annual caps by 2007 of 39 kilotonnes of NO_x emissions from fossil fuel-fired plants (greater than 25 megawatts) within the Ontario portion of the Pollution Emission Management Area ("PEMA"). The cap goes into effect in year 2007. (Note: the 39 kilotonne cap on NO_2 emissions is equivalent to a 25.4 kilotonnes cap on NO emissions).
- Implementing stringent emission reduction regulations, aligned with the U.S. for: cars, vans and light duty trucks; cleaner small engines for off-road equipment and outboard motors; and, future diesel engines and fuel standards.

specific emission control obligations for a region in Canada and the U.S. referred to as a Pollution Emission Management Area (PEMA) to which the obligations of the Annex apply. In Canada, the PEMA includes central and southern Ontario and southern Quebec. In the United States the PEMA includes 18 states stretching from Wisconsin to Maine plus the District of Columbia (DC).

The Ozone Annex specifies emissions reductions for three major sectors in both Canada and the U.S.: industry, transportation and electricity. For mobile sources, the Annex commits to ensuring that new vehicle emission standards are aligned with the United States. The Annex also commits Canada to capping emissions of NO_x from Ontario's electricity generators through an emissions cap of 39 kilotonnes (as NO_2). Canada estimates that the total year-round NO_x reductions in the Canadian transboundary region (consisting of southern Ontario and southern Quebec) will be 44 per cent by 2010.

As part of this Annex, the federal government also announced their intention to upgrade their air quality monitoring network, and expand their emissions reporting regulation to include smog related pollutants.

Clean Air Action Plan

On February 19, 2001, the federal government announced the Clean Air Action Plan to address Canada's obligations under the Ozone Annex to the Canada-US Air Quality Agreement. This included funding for measures to reduce VOC emissions from a range of products including paints and paint coatings, degreasing agents and solvents. Research funding was also allocated to conduct research on transboundary smog and regional risk analysis to characterize major sources of smog in selected regions of Canada.

In addition, the plan commits to transportation initiatives aimed at developing and implementing vehicle regulations, laboratory testing of vehicles, and support for a scrappage program for high emitting vehicles. Monitoring and reporting activities include adding up to 10 new monitoring stations and upgrading existing stations and expanding the National Pollutant Release Inventory (NPRI) to include annual reporting of NO_x, VOC, SO_2, PM and carbon monoxide (Environment Canada Web site).

Interim Plan 2001 on Particulate Matter and Ozone

The Government of Canada released the "Interim Plan 2001 on Particulate Matter and Ozone" on April 26, 2001. This is the first implementation plan - a commitment made by all jurisdictions when signing the CWS for PM and ozone (please refer to Section 1.1, '*Chronology of Action*'). The plan sets out a series of commitments, initiatives and actions, and includes a mix of measures aimed at reducing transboundary pollution, and targeting mobile sources through aligning vehicle emission standards for cars, trucks, diesel engines, off-road engines, and sulphur fuel standards for gasoline and diesel with the U.S..

Pollution prevention partnerships aimed at the industrial sector are also included as is a 10-year plan to reduce VOC emissions from consumer products. Enhancing and maintaining the air quality monitoring network to meet the requirements of the CWS for PM and ozone and the Ozone Annex is also tabled.

Declaration of Particulate Matter as a Canadian Environmental Protection Act Toxic

The federal government (Environment Canada and Health Canada) announced on May 9, 2001, that respirable particulate matter less than 10 microns (PM_{10}) be added to the List of Toxic Substances in Schedule 1 of the Canadian Environmental Protection Act (CEPA).

2.4 Progress by Non-Government Partners and Others

NON GOVERNMENT ORGANIZATIONS

TORONTO ENVIRONMENTAL ALLIANCE (TEA)

The Toronto Environmental Alliance was formed in 1988. TEA's mandate is to work with concerned individuals, public health agencies, local governments and grassroots organizations in order to encourage the participation of Toronto citizens on local issues and to provide a forum for citizens to be heard on environmental issues. One of TEA's six major campaign areas is related to smog and climate change. TEA's Smog and Climate Change Campaign for the year 2000 to 2001 incorporated a number of components aimed at raising awareness of smog impacts and sustainable transportation initiatives. TEA is working to build support for public transit and make Toronto more bike and pedestrian-friendly. TEA's Repair Our Air project focuses on establishing corporate anti-idling and car-pooling programs, as well as a public education campaign through public service announcements on radio and other media. GO Transit is a participant in this program, with a goal of reducing engine idling and fuel consumption (Toronto, June 2001). Finally, TEA is actively networking to assist other Ontario communities (e.g., London, Windsor, Hamilton) to develop and implement municipal smog plans.

ONTAIRIO CAMPAIGN

The "OntAIRio Campaign" is a combined effort of the David Suzuki Foundation, the Sierra Club of Canada and the Toronto Environmental Alliance (TEA).

This coalition has been created to address Ontario's air quality and utilizes research and lobby action to promote clean air by studying emissions from Ontario electricity generators and other significant polluters. OntAIRio bases its directives on the Ontario Medical Association's (OMA) paper, "Health Effects of Ground-Level Ozone, Acid Aerosols and Particulate Matter", published in May 1998.

POLLUTION PROBE

Pollution Probe is a Canadian environmental organization that carries out research and promotes understanding on environmental issues through education. Probe's air program promotes tougher controls on urban smog, reduced acid gas emissions, improved public transit, and cleaner vehicles and fuels. Pollution Probe's Clean Air CommuteTM is the most significant awareness and action component under their air program. Under-taken every year since 1993, the Commute is a corporate event that challenges participants to choose a cleaner way to commute to work by using public transit, cycling, carpooling, telecommuting or tuning their vehicles and inflating the tires. During the week of June 24 to 28, 2001, the Clean Air CommuteTM brought together 145 workplaces in the Greater Toronto Area with a total employee base of more than 100,000 individuals. This initiative saved 285 tonnes of pollutants (including the greenhouse gas carbon dioxide) from going into the air.

Pollution Probe has also undertaken significant research on the use of emissions trading as a tool to facilitate more cost-effective reductions in air pollution and greenhouse gas emissions. The Ministry of the Environment has been a lead sponsor of this awareness and action campaign during the past few years.

ONTARIO LUNG ASSOCIATION

The mission of the Ontario Lung Association (OLA) is to improve respiratory health through fundraising activities for the support of medical research and community health programs. A recent initiative of the OLA relating to air quality concerns was the hosting of the "Better Breathing Conference" in January, 2001. This conference brought together leaders in respiratory and environmental health to discuss air quality health concerns. Ongoing campaigns include providing public health information for coping with smog days and the Movement for Clean Air Now campaign (C.A.N.DO). This program is an environmental health campaign that focuses on both indoor and outdoor air quality, although the primary focus of most initiatives to date has been on indoor air quality. The goals of the campaign are to increase public understanding of the link between respiratory health and air quality, and to motivate action on an individual level to improve air quality.

THE CLEAN AIR FOUNDATION

The Clean Air Foundation (CAF) is a non-profit organization focusing on the facilitation and funding of public engagement programs that will lead to measurable improvements in air quality that can be sold through the Emissions Reduction Trading system. CAF programs include Car Heaven, Clean Start, and Mow Down Pollution, all of which have received Ministry of the Environment funding.

Car Heaven is a program that encourages an acceleration of the retirement of older, higher polluting vehicles by offering the incentive of a charitable tax receipt of a minimum of $60.00 per car. Proceeds of the sale of the car parts support charitable organizations, including the Kidney Foundation of Ontario and Recycling Council of Ontario. The Clean Start Program is an initiative that promotes responsible car maintenance and driving habits in an attempt to reduce the impact of vehicles on the environment through the dissemination of educational brochures. The Mow Down Pollution Initiative is intended to encourage the replacement of older, highly polluting lawn mowers through the financial incentive of a coupon towards the purchase of a new electric or cordless rechargeable mower at designated Home Depot outlets. Clean Air Foundation's Partners also include, among others: Environment Canada, Ontario Power Generation, Toyota Canada, Ford Motor Company of Canada, Imperial Oil, Canadian Petroleum Products Institute, ProtectAir, Black and Decker, The Lung Association and Pollution Probe.

RESEARCH PARTNERS

CENTRE FOR RESEARCH IN EARTH AND SPACE TECHNOLOGY

The Centre for Research in Earth and Space Technology (CRESTech) is one of four Ontario Centres of Excellence (OCE), delivering research excellence to Canada's environmental, resource management, and space sectors. CRESTech's research program is conducted within Ontario's universities and is supported by industrial and government partners.

CRESTech is actively engaged in the modeling and prediction of air quality, based on information from emission sources and local weather conditions. One of the modeling projects was focused on enhancing and commercializing an innovative air quality system based on "Models-3", developed by the United States Environmental Protection Agency, and in collaboration with

CRESTech, York University, the National Research Council, Rowan Williams Davies & Irwin, Inc., the Canadian Gas Research Institute, Environment Canada and Dofasco Ltd.

CRESTech and its partners have established a new Centre for Atmospheric Sciences at the University of Waterloo, to develop expertise and train students in the use of advanced air quality modeling, monitoring and measurement technologies. The Centre has been working with MOE to establish and run the Models-3 to evaluate the impacts of smog.

CHAPTER 3

3.0 Evaluating Progress in Achieving Smog Reduction Targets

This section reviews how we are fairing in terms of the goals for reductions of NO_x, VOCs, SO_2, and Particulate Matter ($PM_{2.5}$/PM_{10}) and improving air quality[9]. These pollutants are significant precursors of the two main components of smog, ozone and fine particles ($PM_{2.5}$) in ambient air, as well as acid rain. Reducing these precursors will also advance Ontario's commitment to achieve the Canada Wide Standards for $PM_{2.5}$ and ozone.

3.1 NO_x

As table 3.1.1 indicates, from 1990 to 1999, total provincial emissions of NO_x have reduced by 109 kilotonnes[10]. Total point sources have declined by 56 kilotonnes. NO_x emissions from mobile sources have declined by almost 76 kilotonnes, or 30 per cent, due to the introduction of cleaner vehicles and fuels over the 1990 to 1999 timeframe. These reductions are offset to some extent by growth in emissions from off-highway engines and other area sources, which increased by 27 kilotonnes.

Since 1998 (the last time progress was studied for ASAP progress reporting), NO_x emissions in Ontario have increased by approximately four kilotonnes. Point source emissions have remained stable over this time period. The steel sector has achieved a reduction of approximately five kilotonnes, electricity emissions are down by five kilotonnes, and petroleum refiners in Ontario have reduced emissions by two kilotonnes. ASAP partners whose emissions have increased over this time period include the cement and chemical sectors, by approximately seven kilotonnes and five kilotonnes, respectively. Between 1998 and 1999, area source emissions from off-highway engines have increased by almost 11 kilotonnes, and rail, air and marine transport emissions have remained steady at 44 kilotonnes. NO_x emissions from mobile source have declined by seven kilotonnes.

Where will Ontario's emission levels be in the future with respect to the NO_x emission targets - a 45 per cent reduction from the 1990 emission level of 659 kilotonnes[11]? As table 3.1.1 shows, most industry sectors are reporting stable emissions or declining emissions due to minimal growth and/or the implementation of new technology or implementation of Ontario's Boiler Guideline. For instance, the steel sector is reporting that emissions will stabilize by 2005 and decline to 12 kilotonnes by 2010, and 11 kilotonnes by 2015. The chemical sector is anticipating reductions of NO_x to be realized by 2005 which will bring their emissions to eight kilotonnes.

Emissions from the electricity sector are capped to 2007 and therefore show a declining trend to 2010 and 2015 from 1999 levels. The non ferrous sector is not anticipating growth in emissions and a stabilization of NO_x at roughly two kilotonnes. Sectors that are anticipating growth include the cement sector, which is forecasting higher production levels to meet construction demand. As well, the petroleum refining sector has estimated an increase in refining intensity in order to meet new

[9] For information on the methods to assess progress, please see Section 1.0, Approach to Evaluating Progress, as well as the overview box entitled Approach to Estimating Future Emissions.

[10] Emissions reported from ASAP partners are combined with other non-ASAP partners in order to complete the emissions inventory for 1990 to 1999. Emissions reported by some ASAP partners (chemical, pulp and paper and electricity do not represent the entire sector, therefore emissions from other sources have been included.

[11] In 1996, when the ASAP was initiated and smog reduction targets established, the 1990 provincial emissions were approximately 659 kilotonnes. Today, through the refinement of emissions inventorying, the 1990 emissions are slightly lower; however, the original smog reduction targets are retained.

standards for low sulphur gasoline and diesel, and a subsequent increase in emissions of NO_x by approximately seven per cent.

Efforts to address emissions from off-road engines were discussed in Section 2. Environment Canada is working to improve the design and manufacturing of off-road engines by aligning future off-road standards with those of the federal U.S. Environmental Protection Agency. While NO_x reductions are anticipated to be significant, presently, reduction estimates are not available for inclusion in the table. For this reason, a range of emission scenarios are provided to estimate the potential future emissions. By 2010, emissions from this source may be in the range of 98 to 120 kilotonnes (at a negative one per cent to one per cent growth rate), and by 2015, could be between 91 and 127 kilotonnes. The same growth scenario was applied to estimate future emission levels from railroad, air and marine modes of transport. By 2010, emissions from these sources could be between 39 and 49 kilotonnes, and by 2015, could be from 37 to 51 kilotonnes.

Future modelling work focused on mobile sources (please see "Approaches to Estimating Future Emissions") will also help to identify the most suitable scenario of emissions reductions from cars and heavy trucks. Here, a range approach is used to provide estimates based on the Ministry of the Environment's Mobile 5C and SENES-Environment Canada data based on Mobile 6. By 2010, emissions from mobile sources could be between 99 and 106 kilotonnes, and by 2015, significantly less, at between 55 and 80 kilotonnes.

Table 3.3.1 indicates the 'gap' - the reductions that would be required to achieve the target NO_x emissions level of 363 kilotonnes by 2010 or 2015. By 2010, emissions of NO_x may be in the range of 396 to 434 kilotonnes. To achieve the province's NO_x target emission level of 363 kilotonnes by 2010, an additional reduction of 33 to 71 kilotonnes of NO_x will be required. By 2015, due to greater emission reductions from cleaner vehicles and fuels, Ontario may be required to achieve up to a further 57 kilotonnes reduction, depending on the extent of reductions as outlined under the assumptions above.

TABLE 3.1.1 NO_x EMISSIONS - CURRENT AND ESTIMATED FUTURE (KILOTONNES)

	1990	1998	1999	2005	2010	2015
POINT SOURCES						
Steel	15	18	13	13	12	11
Cement	19	14	21	23	23	24
Petroleum Refining	14	11	9	9	9	9
Chemical	11	6	11	8	8	8
Pulp and Paper	12	9	10	10	10	10
Non Ferrous Smelting	52	2	2	2	2	2
Electricity	78	87	82	55	43	43
Other Manufacturing	26	24	24	23	25	26
Total Point Sources	**227**	**171**	**171**	**143**	**132**	**133**
AREA SOURCES						
Off-Highway Engines	82	98	109	103-115	98-120	91-127
Railroad, Air & Marine	49	44	44	42-46	39-49	37-51
Residential & Commercial	24	25	25	26	27	28
Surface Coating	0	0	0	0	0	0
General Solvent Use	0	0	0	0	0	0
Dry Cleaning	0	0	0	0	0	0
Fuel Marketing	0	0	0	0	0	0
Other Area Sources	2	0	1	1	1	1
Total Ontario Area Sources	**156**	**168**	**179**	**172-187**	**165-196**	**157-207**
MOBILE SOURCES	**270**	**201**	**194**	**130-171**	**99-106**	**55-80**
TOTAL EMISSIONS	**653**	**540**	**544**	**445-502**	**396-434**	**345-420**
GAP ANALYSIS						
TARGET				**494**	**363**	**363**
GAP				**–49-(–)8**	**33-71**	**–18-57**

[12] A negative number indicates the target will be met under the growth scenarios. For instance, by 2005, Ontario should meet its interim target of a 25 per cent reduction of NO_x emissions from the 1990 base year level. It is anticipated that emissions will be in the range of 445-502, thus exceeding the target emission level of 494 kilotonnes by between 49 and 8 kilotonnes. The interim target was established as part of MOE's business planning targets under ASAP.

APPROACH TO ESTIMATING FUTURE EMISSIONS

Point Sources:

- ASAP's industrial partners have reported NO_x, VOC and SO_2 emissions estimates based on their best under standing of future emissions (2005, 2010, 2015), incorporating production increases and factoring in reductions due to the implementation of technology, best management practices, the Ontario boiler guideline A-9, etc.

- NO_x, VOC and SO_2 emissions from "Other Manufacturers" were grown by one per cent per year, based on past trends for the "other manufacturing" category. For NO_x, a reduction due to the implementation of Ontario's Guideline A-9, NO_x Emissions from Boilers and Heaters, was factored into these growth projections.

- VOC emission projections from sources that were not provided through the survey were estimated based on a growth range of negative one per cent to one per cent growth in emissions per annum.

Area Sources:

- NO_x, VOC and SO_2 emissions from off-highway engines (lawn mowers, construction equipment, hand-held engines, etc.) and rail, marine and aircraft are projected to decline in the future but the timing and extent of reductions is uncertain. Due to the longevity of the fleet and potential growth in use of such engines, a range of growth estimates was applied, from rates of negative one per cent to one per cent growth per year.

- NO_x, VOC and SO_2 emissions from residential and commercial sources are anticipated to remain stable or increase in the future, since reduction plans are not known for this source category.

- VOC emissions from general solvents and surface coatings have increased since 1990 and no quantifiable reduction initiatives have been planned. For this reason, the emission scenarios considered are based on 0 to one per cent growth. A similar approach was taken to estimate future levels of emissions from fuel marketing, although a negative one per cent to one per cent growth scenario was included in this range instead, due to reductions anticipated from Stage 1 Vapour Recovery.

Mobile/On-Road Transportation:

- Significant NO_x, VOC and SO_2 reductions are anticipated from the transportation (mobile sources) sector due to the implementation of Tier 1 vehicles, National Low Emission Vehicles (NLEV), Tier 2 vehicle standards, and low sulphur fuels and inspection and maintenance programs. However, the extent of reductions and the year by which they will be achieved, is uncertain. The Ministry of the Environment has estimated future emissions from mobile sources using the mobile emission estimation model ("MOBILE 5C") along with data from Ontario's Drive Clean Program. This model estimates a NO_x reduction of 70 per cent from 1990 to 2015. Without considering Drive Clean data and using a modified emission estimation model, SENES consultants and Environment Canada predict even greater reductions of NO_x emissions (up to 86 per cent) and VOCs from vehicles over the same period. Most recently, in January 2002, the U.S. "MOBILE 6" was released for estimating emissions of on-road vehicles in the U.S.. It is expected that the Canadian customization of the model (to "MOBILE 6C") will be completed by fall 2002 and will provide a more accurate estimation of the emission reductions due to improvements in current and future Canadian vehicle standards, cleaner fuels and inspection and maintenance programs (e.g., Drive Clean). In the interim, for the purposes of this analysis, predicted emission reductions estimated through the ministry's model as well as the SENES-Environment Canada data (which may be similar to the results anticipated from "MOBILE 6C") are provided as a range of possible future emission levels.

[13] Emissions reported from ASAP partners are combined with other non-ASAP partners in order to complete the emissions inventory for 1990 to 1999. Emissions reported by some ASAP partners (chemical, pulp and paper and auto manufacturing do not represent the entire sector, therefore emissions from other sources have been included. For instance, emissions of VOCs from the ASAP partner CVMA were 9.3 kilotonnes in 1999 (a 32per cent decrease from 1993 emission levels); however, other auto manufacturing sources contributed over 10 kilotonnes in 1999.

[14] The VOC emission inventory from 1990 to 1999 is currently being reviewed. When the ASAP was initiated and smog reduction targets established, the 1990 provincial emissions were approximately 868 kilotonnes. As indicated by table 3.2.1, through the refinement of emissions inventorying, the 1990 emissions are slightly lower; however, the original smog reduction targets are retained.

3.2 VOC

Total provincial emissions of VOCs have been reduced by 175 kilotonnes between 1990 and 1999[13]. Over that time, point sources have reduced VOC emissions by 34 kilotonnes, with reductions made by pulp and paper, petroleum refining and chemical sectors of two, 28 and six kilotonnes, respectively. Area source VOC emissions have declined by 51 kilotonnes, however, over this time frame, a significant increase from the use of general solvents has occurred (36 kilotonnes). Off-road sources increased emissions by 10 kilotonnes over the nine-year period. Mobile emissions of VOCs have been reduced significantly, by 91 kilotonnes.

Between 1998 and 1999, emissions of VOCs in Ontario have increased slightly, by two kilotonnes. Emissions from industry point sources have declined by one kilotonne. The petroleum sector achieved the greatest decline of VOC emissions, at four kilotonnes, whereas chemical companies' emissions increased by one kilotonne. VOC emissions from auto manufacturers also increased, by about three kilotonnes. Between 1998 and 1999, very little change occurred in emissions from area and mobile sources.

The target set by ASAP for VOC emissions is a 45 per cent reduction from the 1990 emission level of 869 kilotonnes (based on the original Smog Plan[14]) to 477 kilotonnes. For VOCs, the gap required to bridge the target levels is significantly larger than is the case for NO_x, due to the growth in VOC emissions anticipated from the increased use of manufactured products by consumers (residential, institutional and manufacturing sectors).

Industry point sources such as the steel sector, petroleum refiners and chemical companies are planning to continue their trend of lowering VOC emissions. However, growth in emissions is anticipated due to the residential and commercial use of general solvents and surface coatings. As discussed earlier, significant reductions in mobile source emissions of VOCs are anticipated by 2010 and 2015. For instance, by 2010, Tier 2 vehicle standards are expected to result in VOC reductions of approximately 40 to 60 per cent from 1999 levels, depending on the modelling scenario considered. By 2015, emissions are expected to be in the range of 47 to 78 kilotonnes.

By 2010, emissions of VOCs may be in the range of 565 to 611 kilotonnes[15]. To achieve the target emission level for VOCs in Ontario of 477 kilotonnes, a further reduction of about 88 to 134 kilotonnes would be required. By 2015, the estimated range for VOC emissions are between 554 and 607 kilotonnes, which would require a further reduction of 77 to 130 kilotonnes to achieve the province's target level in 2015.

TABLE 3.2.1 VOC EMISSIONS - CURRENT AND ESTIMATED FUTURE (KILOTONNES)

	1990	1998	1999	2005	2010	2015
POINT SOURCES						
Steel	26	25	25	0	0	0
Cement	N/A	N/A	N/A	N/A	N/A	N/A
Petroleum Refining	35	11	7	7	7	7
Chemical	18	11	12	7	7	7
Pulp and Paper	11	9	9	9	9	9
Non Ferrous Smelting	0	0	0	0	0	0
Electricity	1	0	1	1	1	1
Auto Manufacturing	17	17	20	19-21	18-22	17-23
Other Manufacturing	41	42	41	39-43	37-45	35-48
Total Point Sources	**149**	**116**	**115**	**82-89**	**77-92**	**74-96**
AREA SOURCES						
Off-Highway Engines	41	51	51	49-54	46-57	44-60
Railroad, Air & Marine	16	19	19	18-20	17-21	17-23
Residential & Commercial	116	83	83	83-89	83-93	83-98
Surface Coating	122	67	67	67-68	67-71	67-75
General Solvent Use	124	160	160	160-169	160-178	160-185
Fuel Marketing	35	37	37	34-39	34-41	32-44
Other Area Sources	20	15	12	14-15	15-16	16-17
Total Ontario Area Sources	**484**	**424**	**433**	**433**	**433**	**433**
MOBILE SOURCES	**230**	**139**	**139**	**81-102**	**55-86**	**47-78**
TOTAL EMISSIONS	**862**	**685**	**687**	**596-624**	**565-611**	**554-607**
GAP ANALYSIS						
TARGET				**651**	**477**	**477**
GAP				**–55-(–)27**	**88-134**	**77-130**

[15] As indicated in the table by a negative number (see 2005), by 2005, Ontario should achieve the interim target of a 25 per cent reduction in emissions from the 1990 base year levels, assuming the various growth scenarios and anticipated reductions to year 2005 are realized. The MOE adopted a VOC interim target as part of a business planning effort under ASAP.

TABLE 3.3.1 SO_2 EMISSIONS - CURRENT AND ESTIMATED FUTURE (KILOTONNES)

	1990	1998	1999	2005	2010	2015
POINT SOURCES						
Steel	27	26	23	23	20	19
Cement	21	17	23	24	24	24
Petroleum Refining	63	64	55	57	59	60
Chemical	8	8	10	10	10	10
Pulp and Paper	17	7	8	8	8	8
Non Ferrous Smelting	693	296	264	279	245	245
Electricity	197	145	144	157	131	131
Other Manufacturing	67	45	17	18	18	19
Total Point Sources	**1103**	**627**	**545**	**576**	**516**	**517**
AREA SOURCES						
Off-Highway Engines	7	4	4	4	3-4	3-5
Railroad, Air & Marine	23	22	17	15-18	15-19	14-20
Residential & Commercial	13	9	7	6-7	6-8	6-8
Surface Coating	0	0	0	0	0	0
General Solvent Use	0	0	0	0	0	0
Fuel Marketing	0	0	0	0	0	0
Other Area Sources	0	0	0	0	0	0
Total Area Sources	**43**	**35**	**28**	**25-30**	**24-32**	**23-33**
MOBILE SOURCES	**21**	**16**	**15**	**4**	**4**	**4**
TOTAL EMISSIONS	**1168**	**678**	**588**	**605-609**	**544-551**	**544-554**
GAP ANALYSIS						
TARGET					**442**	**442**
GAP					**102-109**	**102-112**

3.3 SO_2

Since 1990, emissions of SO_2 have been reduced by approximately 580 kilotonnes, as table 3.3.1 indicates[17]. The most significant reductions have been achieved by the non-ferrous smelters in Ontario, steel companies, petroleum refiners and the electricity sector. Area and mobile sources have also achieved reductions of SO_2, in the order of 15 and six kilotonnes, respectively.

Between 1998 and 1999, most point sources continued to achieve SO_2 emission reductions with the exception of the chemical sector, which experienced a two kilotonne increase, and cement companies which increased by about six kilotonnes. Total point source emissions over this time decreased by 82 kilotonnes. Emissions of SO_2 from Ontario's area sources declined between 1998 and 1999 by seven kilotonnes, as did emissions from mobile sources, by one kilotonne.

Ontario's commitment made under the Canada-Wide Acid Rain Strategy for Post 2000 is a 50 per cent reduction of SO_2 from current Countdown Acid Rain limits of 885 kilotonnes or a target of 442.5 kilotonnes. In 1999, provincial emissions of SO_2 were approximately 588 kilotonnes. The "gap" - or reductions required to achieve the target of 442.5 kilotonnes as of 1999, would be 145.5 kilotonnes.

Looking to the future, emissions of SO_2 are anticipated to continue to decline from the electricity sector and the non-ferrous sector due to the capping of SO_2 emissions at 25 and 34 per cent, respectively. For many other sectors, an increase in emissions is anticipated or uncertainty exists as to future levels. For instance, the cement and petroleum sectors are anticipating an increase to 2010 by one and two kilotonnes, respectively. By 2015, an increase in SO_2 emissions is anticipated from the petroleum refining sector by approximately eight per cent due to increased energy intensity required to achieve limits on sulphur in gasoline and diesel. The pulp and paper and chemical sectors predict stable emissions to 2005, however, there is uncertainty in the trends anticipated from these sectors by 2010 and 2015. Steel producers are expecting emissions of SO_2 to decline by four kilotonnes between 1999 and 2015.

Emissions from mobile sources are anticipated to decline in the future, down to about four kilotonnes. Future emissions from area sources such as residential and commercial sources, rail, air and marine transport, and off-highway engines, are rather uncertain. Therefore, an estimated growth range is provided that shows emissions either decreasing or increasing by negative one to one per cent per annum.

Based on these scenarios, by 2010, Ontario's total emissions of SO_2 are projected to be somewhere in the range of 544 and 551 kilotonnes. To achieve the SO_2 target

[16] Emissions reported from ASAP partners are combined with other non-ASAP partners in order to complete the emissions inventory for 1990 to 1999. Emissions reported by some ASAP partners (chemical, pulp and paper) do not represent the entire sector, therefore emissions from other sources have been included.

FOCUS ON PARTICULATE MATTER

- In 1998, the then-named Steering Committee of Ontario's Smog Plan established the Particulate Matter and Ozone Options Assessment Working Group to develop a strategy for the reduction of inhalable and respirable particles - PM_{10} and $PM_{2.5}$, respectively. This working group was charged with identifying and assessing strategic options to address the particulate matter issue in Ontario and recommend actions to the (now-named) Operating Committee.

- Significant developments made over the past two years in coming to understand the origins and extent of the particulate matter issue in Ontario have been made through research, initiated by the Ministry of the Environment and the ASAP's Particulate Matter and Ozone Options Assessment Working Group.

- In 1999, the key steps forward in enhancing readiness for the development of Ontario's strategy to reduce ozone and particulate matter were made by the Particulate Matter and Ozone Options Working Group: the preparation of PM compendium and strategic options documents; sponsorship of CRESTech/NERAM Expert Panel Review; and, participation in development of Canada-Wide Standards (see Section 1.0, Chronology on Smog Action).

- With this foundation in place, in 2000, the PM/O_3 Working Group modified their mandate to focus more closely on key developments related to the PM and ozone issue. In this vein, the group changed its name to the Particulate Matter and Ozone Science and Policy Assessment Working Group (PM/O_3 SPAWG). This group has since focused more closely on reviewing science and policy development with the goal of continuing to advance a comprehensive strategy to reduce smog - both particulate matter and ozone.

- Tracking progress in smog reduction requires that we track both ozone and particulate matter. The Performance Monitoring and Reporting Working Group (PMRWG) has made progress during the past two years in developing proposed indicators to monitor PM in Ontario. Tracking targets include: i) ambient $PM_{2.5}/PM_{10}$ air trends in Ontario; ii) $PM_{2.5}/PM_{10}$ emissions; and, iii) sectoral contributions to ambient air PM levels apportioned through inventory and mathematical modelling.

- The Ministry of the Environment has increased monitoring for PM_{10}. In 2000, Ontario had a total of 43 ambient PM monitors in operation across Ontario. In 1996, only 20 monitors were operating.

- With a focus on research on emissions inventories, and modelling, CRESTech has recently funded a number of air quality projects on particulate matter, including: ambient air measurement and characterization (G. Harris, York University); secondary particulate modelling (D. Michelangeli, York University); and, source apportionment (J. Hicks, Ryerson University). CRESTech has indicated that all projects are on track and making good progress.

TABLE 3.4.1 $PM_{2.5}$ EMISSIONS - (KILOTONNES)

	1990	1998
POINT SOURCES		
Steel	5.1	7.3
Petroleum Refining	1.3	1.4
Chemical	0.4	0.3
Pulp and Paper	7	4.7
Non Ferrous Smelting	6.6	6.8
Electricity	0.3	0.6
Other Manufacturing	11.9	10.2
Total Point Sources	**26.6**	**26.2**
AREA SOURCES		
Off-Highway Engines	4.8	5.8
Railroad, Air & Marine	2.5	2.3
Residential & Commercial	22.5	22.8
Other Area Sources	5.6	5.2
Total Ontario Area Sources	**57.8**	**54.8**
MOBILE SOURCES	**11.7**	**9.1**
TOTAL EMISSIONS	**84.4**	**81**

by 2010, a further reduction of 102 to 109 kilotonnes may be required. By 2015, the gap required to achieve the SO_2 target may be in the range of 102 to 112 kilotonnes.

3.4 PM

Concentrations of particulate matter ($PM_{2.5}/PM_{10}$) in ambient air result from both primary emissions from sources (e.g., industry) and secondary chemical reactions of precursor gases that form particles (i.e., NO_x, VOCs, SO_2). Together with reductions of NO_x, VOCs and SO_2 emissions (covered earlier), reductions of primary PM emissions will help reduce ambient levels of $PM_{2.5}$ and also ozone.

While much work has been undertaken through the ASAP forum to measure and enhance the tracking of primary and secondary particulate towards a comprehensive smog reduction strategy (please see "Focus on Particulate Matter"),

progress has also been made toward reducing emissions of primary PM.

Some Ontario industry sectors are continuing to make headway in tracking and monitoring $PM_{10}/PM_{2.5}$ emissions reductions. Many industries have lowered emissions of total solid particulate through optimizing dust collector efficiency, installation of state-of-the-art bag houses in their processes and fugitive controls.

The Cement Association of Canada is undertaking research to characterize the fine particulate matter emissions from cement operations and develop action plans to reduce fine particulate emissions. The steel sector is also making progress in controlling emissions of particulates. Green belting (to lower erosion of soil and protection from wind), baghouse upgrades and process changes are some methods being used by the Canadian Steel Producers Association (CSPA) to lower particulate matter of all sizes.

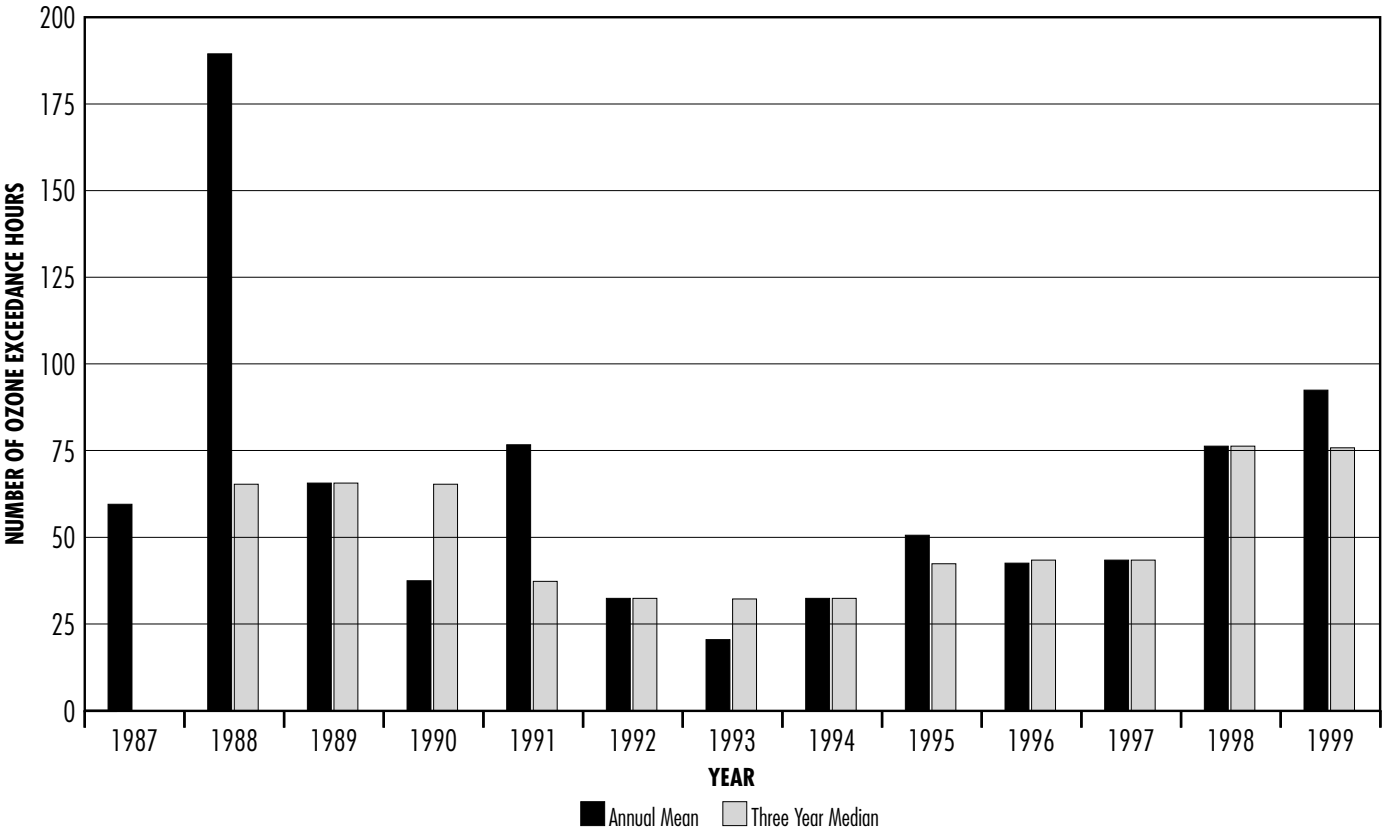
In addition, the Canadian Petroleum Products Institute (CPPI) and the Canadian Chemical Producers Association (CCPA) are working on developing a PM inventory. Specifically, CPPI is undertaking work to finalize a PM emissions estimation methodology, and quantify emissions based on these protocols towards a PM reduction plan over the next couple of years.

As table 3.4.1 indicates (on the previous page), $PM_{2.5}$ emissions data between the years 1995 and 1999 show a reduction of approximately three kilotonnes. The pulp and paper sector has achieved significant progress in reducing emissions of particulate and chemical companies have reduced fine PM emissions. Mobile sources have also achieved a reduction of two kilotonnes.

3.5 ONTARIO'S SMOG LEVELS

Smog - ozone and particulate matter - is a year round problem in Ontario and tracking progress made in reducing smog requires an analysis of both ozone data as well as fine particles - the two constituents of smog. When data from a more extensive $PM_{2.5}$ monitoring effort - over several years - are analyzed, the full smog problem may be tracked and reported on. In the interim, this section only discusses the trends in the number of ozone exceedances and the factors affecting the trends.

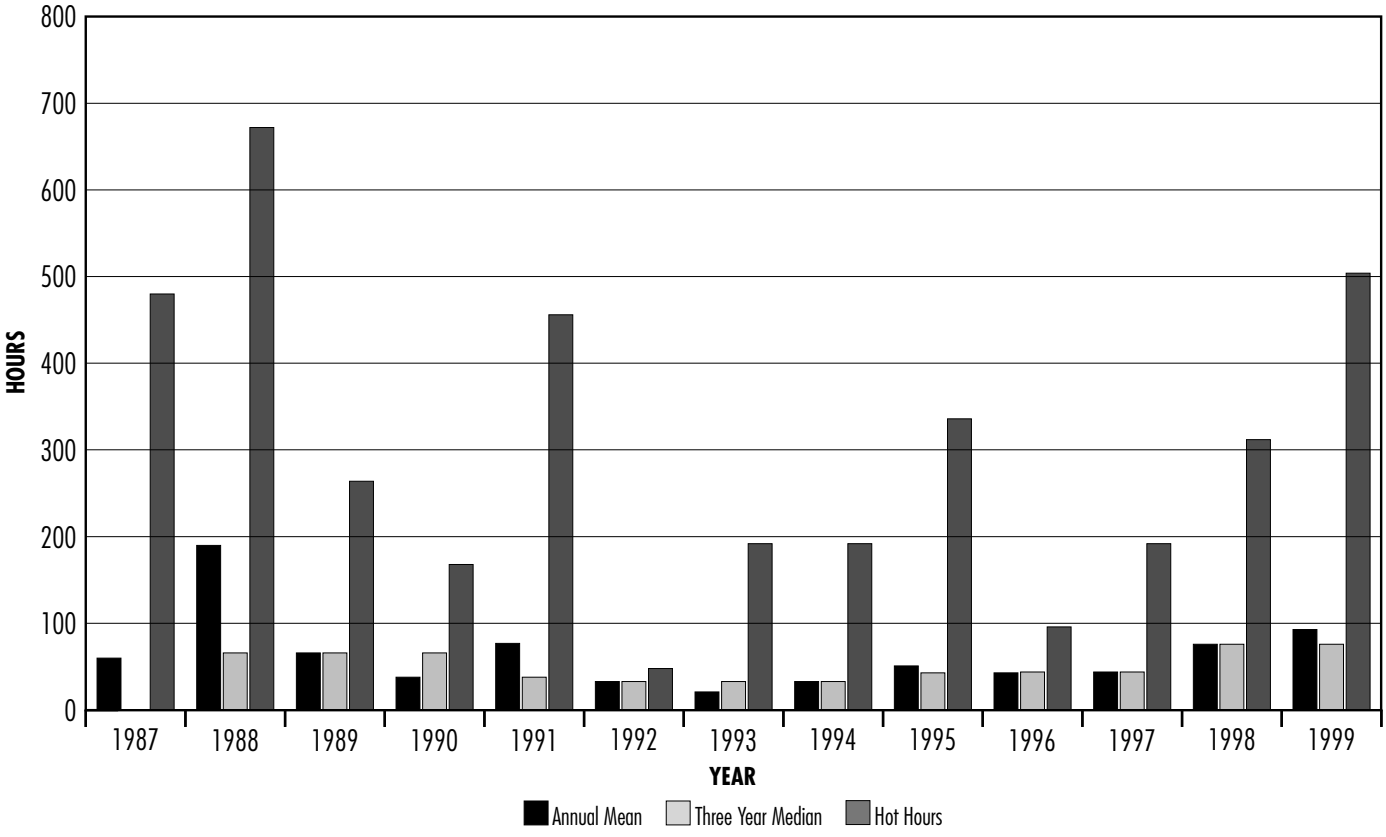
FIGURE 3.5.1 TRENDS IN OZONE EXCEEDANCES



Ontario's ASAP goal is to achieve, by 2015, a 75 per cent reduction in the average number of times the 80 ppb one hour ozone ambient air quality criterion (AAQC) is exceeded. The ASAP's Performance Monitoring and Reporting Working Group investigated a suitable parameter for tracking this goal. The group concluded that a three-year median value of annual arithmetic mean exceedance hours (i.e., the second-highest year in three years) is best suited for this purpose, as it filters out the impact of extreme weather conditions. However, it should be noted that the three-year median still does not completely eliminate the impact of meteorology nor does it account for the transboundary flow of emissions. During summer months in Ontario, winds are typically from south/south-west, carrying over significant quantities of ozone and ozone precursors into Ontario from the U.S. states, particularly those bordering Ontario. Up to 50 per cent of Ontario's ozone can be from U.S. smog precursor emission sources. The ASAP goal requires that the U.S. achieve reductions of NO_x and VOCs that are at least equivalent to Ontario's target of a 45 per cent reduction of 1990 levels.

The Ministry of the Environment has set up a network of ambient air quality (AAQ) monitoring stations to measure ozone levels in various parts of Ontario. The ministry tracks and reports the number of hours during which the ozone level has exceeded the provincial hourly ozone standard of 80 parts per billion and the number of hot days (i.e., days with daytime maximum air temperature above 30 degrees Celsius). Figure 3.5.1 shows the trend of the annual average and the three-year median ozone exceedance hours for 22 ambient air ozone monitoring stations in Ontario from 1987 to 1999. The number of annual ozone exceedance hours varied considerably throughout this period, ranging from 21 to 190 hours. The lowest number of exceedances was in 1993 and the highest was in 1988. The three-year median trend line indicates that although the initial trend was downwards, ozone exceedance hours have been rising slowly after 1993 and appear to hold steady at 45 hours per year until 1997. The ozone exceedances trends are a result of a combination of factors

FIGURE 3.5.2 TRENDS IN OZONE EXCEEDANCES& HOT HOURS



such as ozone precursor emissions levels, magnitude of transboundary pollution, meteorological impacts and the geographic distribution of ozone.

Smog Exceedances and Hot Days

The high number of ozone exceedances observed in 1998 can be attributed in part to hot and dry weather conditions that year, that are conducive to the formation of ground-level ozone. The low number of exceedances in 1993 and 1994 are reflective of the cool, wet conditions experienced in those years. The importance of meteorology in the production of ozone is demonstrated by comparing the number of hot days (those with maximum temperatures above 30 degrees Celsius) with the ozone exceedance data (Figure 3.5.2).

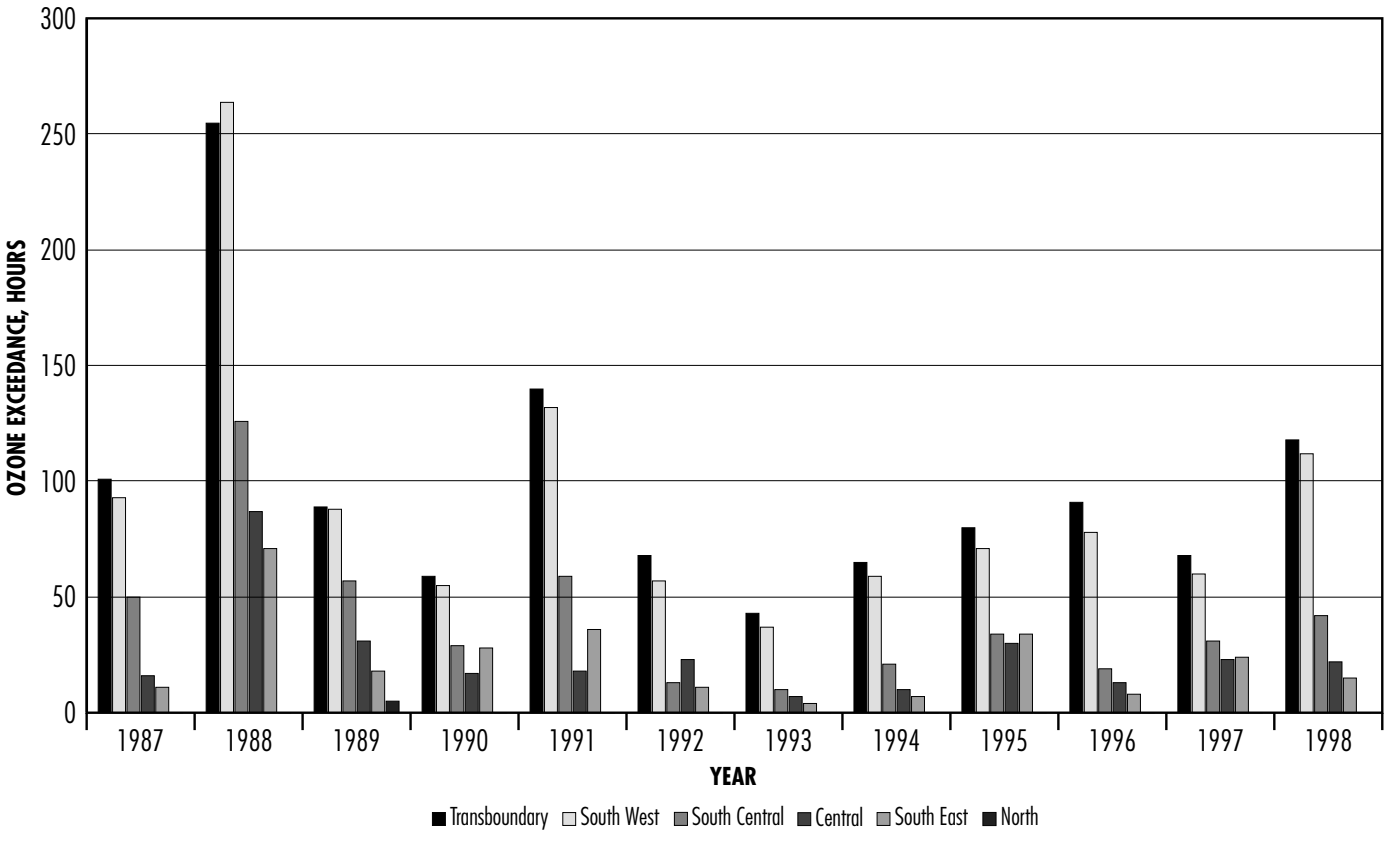
The highest number of hot days recorded is 28 in 1988 (recorded as 672 hot hours in the graph), which is also the year of highest ozone exceedance hours (190 exceedance hours). The year with the lowest number of hot days (two days, or 48 hours) is 1992. This is also the second lowest year of ozone exceedance hours (60 hours) – suggesting there is a correlation between hot days and ozone exceedances. However, this is not always the case. For instance, in 1997, there was an increase in the number of hot days relative to 1996, but there is no corresponding change in relative ozone exceedances in that period.

Transboundary Pollution

Significant levels of ozone are transported into Ontario from the U.S. During periods of widespread elevated ozone it is estimated that more than 50 per cent of Ontario's smog can be attributed to transboundary pollution. Wind direction significantly influences the transport of pollution and episodes of smog over southern Ontario. In the summer months particularly, southwest winds into Ontario can transport high levels of pollutants. Wind speed (e.g., winds above 10km/h), large-scale weather patterns and other meteorological factors can also affect the frequency of elevated ozone episodes and the magnitude of pollution transport from the U.S.

Geographical distributions of ozone exceedances can help to explain the transboundary influences on the ozone exceedance trends experienced in Ontario. Figure 3.5.3 shows the variation of

FIGURE 3.5.3 OZONE EXCEEDANCE ZONES



ozone exceedances in the five Ministry of the Environment regions of Ontario and Transboundary (U.S./Ontario border points) locations.

Monitoring sites are divided into the following zones:

- transboundary sites along the northern shore of Lake Erie and the eastern shore of Lake Huron (Long Point, Mandaumin, Merlin, Sarnia, Simcoe, Tiverton, Windsor)
- southwest sites (Guelph, Kitchener, London, Parkhill)
- south central sites in the urban areas (Greater Toronto Area, Hamilton/Burlington, Niagara Falls, St. Catherines)
- central sites (Barrie, Oshawa) southeast sites (Cornwall, Kingston, Peterborough)
- north sites (Dorset, North Bay, Sudbury, Sault Ste Marie)

The transboundary and south west sites experienced the highest levels of ozone due to the strong influence of transboundary pollution. The remaining four regions have a lower number of ozone exceedances by a factor of two to five, with the northern region having zero (0) exceedance hours after 1989. While the south central region shows a steady increase in ozone exceedance hours after 1996, the southwest, central and eastern regions data do not show the same trend.

The flow of transboundary pollutants is especially important from the Pollutant Emission Management Area (PEMA), an area that includes all 18 U.S. states within 500 kilometres of the border of eastern Canada, plus parts of southern and central Ontario and Quebec[17]. Reductions in this 18-state region (including the District of Columbia) will have the greatest impact on air quality in southern Ontario, southern Quebec as well as the Atlantic provinces. Table 3.5.1 summarizes the 1990 and 1998 emissions from those 18 states.

The data show that NO_x emissions have decreased by 4.2 per cent since 1990 and VOCs have been reduced by 16.6 per cent. Of these 18 states, the seven that most significantly affect Ontario's air quality are Ohio, Illinois, Indiana, Pennsylvania, Michigan, New York and West Virginia. These states have reduced collective NO_x emissions by 2.1 per cent from 1990 levels and VOCs by 14.6 per cent.

Data show that neighbouring U.S. states contribute significant levels of smog in southern Ontario. The quantitative contributions from transboundary air pollution and local sources remain significant. To this end, it will be important to continue to track changes in U.S. emissions of the 18 PEMA states and ozone levels at U.S./Canada border air monitoring stations in addition to data on particulate matter.

TABLE 3.5.1 EMISSIONS REDUCTIONS OF 18 U.S. STATES SINCE 1990

Emissions	1990 (kt)	1998 (kt)	Reduction (short tons)	Reduction (per cent)
NO_x	8751	8386	364	4
VOCs	7319	6106	1212	16
SO_2	12191	9312	2878	23
PM_{10}	6688	6114	574	8
$PM_{2.5}$	1951	1746	205	10

[17] The PEMA states as defined in the Ozone Annex, are Connecticut, Delaware, District of Columbia, Illinois, Indiana, Maine, Maryland, Massachusetts, Michigan, New Hampshire, New Jersey, New York, Ohio, Pennsylvania, Rhode Island, Vermont, Virginia, and West Virginia.

CHAPTER 4

4.0 Complementary Air Quality Initiatives

This section highlights the Ministry of the Environment and City of Toronto air quality initiatives that are in addition to progress reported by ASAP partners.

4.1 MINISTRY OF THE ENVIRONMENT

Air Quality Criteria and Monitoring

Strong air quality standards form the foundation of the traditional ministry program for protecting health and safeguarding the ecosystem. In an effort to update Regulation 346, Ontario's current general air pollution regulation for stationary sources, the ministry has undertaken a major review and update of 145 air standards. In March 2001, decisions on 18 high priority air standards were posted on the Environmental Bill of Rights (EBR) registry. Of the 18 decision notices posted, standards for 14 substances were strengthened. Four standards were reaffirmed as being protective at their current levels.

U.S. EPA Intervention

Smog-causing emissions from the United States account for more than half of Ontario's smog problems. In the U.S., the Environmental Protection Agency has implemented a NO_x State Implementation Plan (SIP) Call, which requires 19 states (plus the District of Columbia) in the northeastern portion of the U.S. to reduce NO_x emissions during the smog season (May to September) and submit a comprehensive reduction plan on how reductions will be achieved.

A coalition of U.S. electrical utilities and seven U.S. states – Alabama, Michigan, West Virginia, Virginia, South Carolina, Indiana and Ohio – challenged the SIP Call and filed petitions with the U.S. Supreme Court in an effort to have the case reviewed. On January 4, 2001, Ontario filed a brief in the U.S. Supreme Court opposing these petitions.

In March 2001, the U.S. Supreme Court ruled in favour of the U.S. Environmental Protection Agency in its effort to require reductions of the states' smog emissions. Ontario was the only Canadian jurisdiction to intervene as a party in this case.

4.2 CANADIAN COUNCIL OF MINISTERS OF THE ENVIRONMENT

Canada-Wide Standards

In June 2000, the Canadian Council of Ministers of the Environment (CCME) endorsed Canada-Wide Standards for ozone and particulate matter (PM), to be achieved in 2010. The ASAP report, "A Compendium of Current Knowledge on Fine Particulate Matter in Ontario", (March 1999) was a key resource in the development of Canada-Wide Standards (CWS) for PM.

For Ontario, a 45 per cent reduction in NO_x and VOC emissions from 1990 levels represents the province's fair-share contribution towards achieving the ozone CWS. Any remaining ambient ozone levels above the CWS in Ontario can be attributed to transboundary flow from the U.S. of ozone and precursor pollutants.

As part of the endorsement of the CWS for PM and Ozone, CCME ministers also committed to several Joint Initial Actions (JIAs) aimed at reducing levels of PM and Ozone. The JIAs included the development of Multi-Pollutant Emission Reduction Strategies (MERS) for several sectors.

Joint Initial Actions to Reduce Pollutant Emissions That Contribute to Particulate Matter and Ground-level Ozone

Following the June 2000 CCME meeting, ministers agreed on a set of initial actions to reduce the pollutants that cause particulate matter and ground-level ozone to be undertaken jointly by provincial/territorial and federal governments. Sectors included in the initial joint actions were selected based on current emission inventories (i.e., being significant emitters of the precursor pollutants

that cause PM and ozone) as well as being conducive to resolution through a multi-jurisdictional approach. Some significant sectors included are iron and steel, pulp and paper, and non ferrous smelters. It is intended that the full set of initial actions will be completed by 2005.

a) Multi-Pollutant Emissions Reduction Strategy: MERS is a national picture of sectoral emission reduction plans, to be built from jurisdictional plans on Particulate Matter (PM) and Ozone and national multi-pollutant analysis.
MERS will be undertaken in partnership with provinces, territories and stakeholders, and will focus on three general activities:
i)multi-pollutant Emissions Reduction Analysis Foundation (MERAF) reports that will be based on industry profiles, technical feasibility studies, policy instruments, etc. The compilation of technical information as input into the development of sectoral actions in jurisdictional plans will be carried out by Technical Advisory Networks;
(ii) information sharing and consultation; and,
(iii) national sector roll-up to be assembled by 2003 based on above activities.

Research into the human health and environmental impacts of particulate matter and ozone is also taking place independently, to enable completion of the 2005 PM and Ozone CWS review.

4.3 SMOG SUMMIT 2001

The inaugural Toronto Smog Summit in June 2000, brought together the City of Toronto, the Province of Ontario, the Federal Government and 300 citizens, business and community leaders, to develop a suite of short-term, concrete measures that would improve air quality during the summer of 2000. The Smog Summit resulted in the signing of the Toronto Inter-Governmental Declaration on Clean Air by the three levels of government. Smog Summit II involved several municipal governments within the GTA (City of Markham, York Region, Peel Region, City of Oshawa, and the City of Mississauga). It showcased municipally-sponsored initiatives, community activities, and private sector partnerships that provide innovative ways to address the smog problem.

FOCUS ON SMOG SUMMIT II

- The **City of Toronto** committed to a number of actions, including the Better Transportation Partnership (BTP). BTP is a new alternative transportation initiative aimed at accelerating the replacement of the city's vehicle fleet, and that of its agencies, boards and commissions, by offering the opportunity to acquire one additional light duty dedicated natural gas vehicle for every four purchased or leased.

- The **Toronto Atmospheric Fund** approved more than $2,800,000 in grants and loans for City of Toronto initiatives and more than $467,000 for community-based projects, focused on reducing greenhouse gas emissions and improving local air quality.

- The **Region of Peel** made commitments to such initiatives as the development of a corporate fleet emission reduction strategy that will focus on the continued purchase of low sulphur fuel and an accreditation program to conduct in-house testing of fleet emissions. Peel proposed a Transportation Master Plan for the region that will see such initiatives as the development of carpool lots. Finally, Peel will continue to participate in the 20/20 The Way to Clean Air project with Toronto Public Health and work with other community partners who are active on environmental issues related to air quality.

- The **Ministry of the Environment** committed to a number of activities for 2001-2002, including the review of results from a series of public consultation on Ontario's Drive Clean Program to ensure continuous program improvement, and improved public access to emissions data obtained through the mandatory monitoring and reporting regulation. In the area of fuels and mobile source emissions, Ontario has proposed to extend existing retail sales tax rebates for alternative fuel cars to cover electric hybrid cars and to create a legislative committee to investigate environmentally-friendly, sustainable alternatives to our existing fuel sources. Finally, together with Environment Canada and the City of Toronto, Ontario has agreed to continue to co-fund the Toronto Region Sustainability Program through the Ontario Centre for Environmental Technology Advancement (OCETA).

- **Environment Canada** announced that the focus of the year 2002 smog summit activities will be to assist in the development of a Canadian Fuel Cell Alliance to focus on alternative efficiency vehicles. The federal government also announced an agreement with the Canadian Vehicle Manufacturers' Association and Association of International Automobile Manufacturers of Canada to market low-emission vehicles beginning in 2001. The federal government also committed to ensuring fuel efficiency in light duty vehicles is improved by 25 per cent by the year 2010.

CHAPTER 5

5.0 Conclusions and Lessons

This report documents the various ways that ASAP participants - representing industry, government and non-government agencies, as well as academia - are continuing their efforts to reduce smog levels in Ontario. The conclusions drawn around the report's two themes are discussed here.

RECOGNIZING EFFORTS

- Many ASAP partners have helped to pave the way forward for more action on smog in the province. Since the last progress report, many groundbreaking initiatives have been implemented such as the setting of tough emissions caps for the electricity sector - one of Ontario's key smog contributors. The Ministry of the Environment's emissions reduction trading program provides industry an incentive for lowering emissions and will help level the playing field among anti-smog participants.

- Since progress was last reported, significant changes have been made to how industry will report data and share that information with the general public through Ontario's monitoring and reporting regulations (Ontario Regulation 127/01). The ASAP emissions survey was a significant step forward in tracking smog emissions and proved to be an effective interim measure to obtaining a more complete inventory.

- Strong efforts have been made to enhance education and awareness of smog reduction through such programs as Pollution Probe's Clean Air Commute.

EVALUATING PROGRESS IN ACHIEVING SMOG TARGETS

Since 1990, good progress has been made in reducing absolute emissions that contribute to smog and acid rain.

- Between 1990 and 1999, total provincial emissions of NO_x were reduced by 109 kilotonnes. Industrial sectors have lowered emissions by 56 kilotonnes through various technology controls and fuel switching, and further progress is expected with the implementation of Ontario's Boiler Guideline. Advancements in cleaner vehicles and fuels have also lead to reductions of 76 kilotonnes from mobile sources. A growth in NO_x emissions of 23 kilotonnes was experienced from off-highway engines and other area sources.

- Total provincial emissions of VOCs have been reduced by 175 kilotonnes between 1990 and 1999 with major reductions from industry (34 kilotonnes) and mobile sources (91 kilotonnes). Many area source VOC emissions have declined as well, however, emissions have increased significantly - by 36 kilotonnes - due to the use of general solvents. Off-road sources of emissions also increased over the nine-year period, by 10 kilotonnes.

- Since 1990, emissions of SO_2 have been reduced by 580 kilotonnes with significant reductions made by the non-ferrous smelters in Ontario, steel companies, petroleum refiners and the electricity sector. Area and mobile sources have also achieved reductions of SO_2, in the order of 15 and six kilotonnes, respectively.

Between 1998 and 1999 (the last time progress data were reviewed), emissions reductions have continued by many ASAP partners, but growth from some emissions sources has been experienced.

However, due to the length of time required to introduce emissions reduction measures, studying emissions trends over a longer time period provides a better indicator of progress than a shorter time frame.

- Total NO_x emissions have grown by four kilotonnes due to emissions increases predominantly from non-road engines. NO_x emissions from point sources have stabilized. Over this year period, emission reductions from mobile sources continued to be realized.

- VOC emissions increased by two kilotonnes despite reductions from industry point sources such as the petroleum sector. Increases occurred from auto manufacturers as well as some point sources such as chemical and pulp and paper. Over the long-term, however, ASAP partners representing these sectors have made significant reductions. For instance, CVMA has reduced VOC's by approximately 32 per cent since 1993, and CCPA has achieved a reduction of about 10 kilotonnes between 1992 and 1999.

- Total SO_2 emissions declined by 90 kilotonne since 1998. Between 1998 and 1999, most point sources continued to reduce SO_2 emissions with the exception of chemical and cement companies. Total point source emissions over this time decreased by 82 kilotonnes due to reductions by petroleum refiners and non-ferrous smelters in Ontario. Emissions from Ontario's area and mobile sources declined as well.

Future emissions were estimated through the use of various mobile model and data from the industrial sectors. The resultant inventory shows that more work may be required to achieve smog and acid rain reduction goals.

- For NO_x, the estimated projections indicate that reductions in the order of 33 to 71 kilotonnes would be required to achieve the NO_x emissions level target of 363 kilotonnes by 2010. To do so by 2015, up to a further 57 kilotonnes reduction would be required to achieve the target.

- For VOCs, the estimated projections indicate that reductions in the order of 88 to 134 kilotonnes would be required to achieve the VOC emissions level target of 477 kilotonnes by 2010. To do so by 2015, reductions of 77 to 130 kilotonnes would be required.

- ASAP initiatives have also helped Ontario to achieve SO_2 reductions towards its commitment of 442.5 kilotonnes (50 per cent of the Countdown Acid Rain Cap) by 2015. Reductions of 102 to 109 kilotonnes would be required if the SO2 target was advanced to 2010. To do so by 2015, a further reduction of 102 to 112 kilotonnes would be needed.

Good progress has also been made on reducing particulate matter as part of a comprehensive smog reduction strategy.

- Reductions of NO_x and SO_2 are contributing to lowering secondary particulate matter. Some industries are also reducing primary particulate emissions. A better understanding of sources and emissions of PM_{10} and $PM_{2.5}$ in Ontario as well as transboundary influences on regional air quality will be important to achieving the CWS for $PM_{2.5}$.

Understanding the progress made in reducing smog in Ontario requires that we study trends of ozone and fine particles - the two constituents of smog.

- The ASAP Performance Monitoring and Reporting Working Group has identified parameters for tracking $PM_{2.5}$, but only after data over several years are made available can smog trends be tracked better understood. This report looks at ozone exceedance data only; trends of which are influenced by daily meteorological influences and transboundary flows of pollution. Between 1990 and 1999, the distribution of province-wide ozone exceedance days generally followed the same trend as the number of 'hot days'. In 1999, the smog season recorded the highest number of ozone exceedance days and hot days during the 10-year period. The seriousness of the transboundary impact is also reflected in the geographical distribution of ozone exceedance data which indicate a higher number of hours at elevated ozone concentrations along the eastern shore of Lake Huron and the northern shore of Lake Erie. More than 50 per cent of provincial ozone levels are due to the long-range transport of ozone and its precursors from the U.S..

- A major step forward has been made in formalizing the Ozone Annex to the Canada-U.S. Air Quality Agreement, to ensure that cross-boundary action is taken to reduce emissions that contribute to smog.

GLOSSARY OF ACRONYMS

AAQC	Ambient Air Quality Criterion
AIAMC	Association of International Automobile Manufacturers of Canada
APMA	Auto Parts Manufacturing Association
AQI	Air Quality Index
ARET	Accelerated Reduction of Emissions of Toxics
ASAP	Anti-Smog Action Plan
ASMAC	Adhesives and Sealants Manufacturers Association of Canada
BBP	Better Building Partnership
BTP	Better Transportation Partnership
CAC	Cement Association of Canada
CAF	Clean Air Foundation
CAN.	Clean Air Now
CCME	Canadian Council of Ministers of the Environment
CCPA	Canadian Chemical Producers Association
CEMs	Continuous Emission Monitoring Systems
CEPA	Canadian Environmental Protection Act
CO	Carbon Monoxide
CPCA	Canadian Paint and Coatings Association
CPIA	Canadian Plastics Industry Association
CPPI	Canadian Petroleum Producers Institute
CRESTech	The Centre for Research in Earth and Space Technology
CSPA	Canadian Steel Producers Association
CVMA	Canadian Vehicle Manufacturers' Association
CWS	Canada-Wide Standards
DC	District of Colombia
EAA	Environmental Assessment Act
EBR	Environmental Bill of Rights
EC	Executive Committee
EMS	Environmental Monitoring Systems
EPA	Environmental Protection Agency (U.S.)
EPS	Emissions Performance Standard
ERP	Emissions Reduction Program
ESP	Electrostatic Precipitator
FRED	Fast Reference Emissions Document

GTA	Greater Toronto Area
HARA	Hamilton Autobody Repair Association
IP/RP	Inhalable and Respirable Particulates
KT	kilotonnes (1,000 metric tonnes)
kWh	kilowatt hour
LDAR	Leak Detection and Repair
MEK	Methyl Ethyl Ketone
MERS	Multi-Pollutant Emission Reduction Strategy
MIBK	Methyl Isobutyl Ketone
MOE	Ministry of the Environment
MOU	Memorandum of Understanding
MW	Megawatt
NAPS	National Air Pollution Surveillance
NGO	Non-Governmental Organization
NH_3	Ammonia
NO_x	Nitrogen Oxides (usually sum of NO and NO_2 unless otherwise noted, NO_2= 1.53 NO)
NPRI	National Pollutant Release Inventory
O_2	Oxygen
O_3	Ozone
OC	Operating Committee
OCE	Ontario Centre for Excellence
OCETA	Ontario Centre for Environmental Technology Advancement
OEM	Original Equipment Manufacturer
OLA	Ontario Lung Association
OMA	Ontario Medical Association
OPGI	Ontario Power Generation Inc.
ppb	Parts per billion
ppm	Parts per million
PERT	Pilot Emissions Reduction Trading
PEMA	Pollutant Emission Management Area
PM	Particulate Matter

PM/O_3SPAWG	Particulate Matter and Ozone Science and Policy Assessment Working Group
PMRWG	Performance Monitoring and Reporting Working Group
POI	Point of Impingement
SCR	Selective Catalytic Reduction
SIP	State Implementation Plan
SO_2	Sulphur Dioxide
SOx	Sulphur Oxides
TEA	Toronto Environmental Alliance
TSP	Total Suspended Particulates
TTC	Toronto Transit Commission
VCR	Voluntary Challenge Registry
VKT	Vehicle Kilometers Traveled
VOCs	Volatile Organic Compounds
$\mu g/m^3$	micrograms per cubic metre

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NOTES

TABLE 2.1.1 - INDUSTRY POINT SOURCE REDUCTIONS

Non ferrous Sector

- In September 2001, MOE issued a proposed control order to INCO and Falconbridge to reduce total annual SO_2 emissions by 34per cent by the end of 2006.

Electricity Sector

- The ASAP 2000 Progress Report indicated a 19 kilotonne-reduction due to OPG's voluntary reduction of NO_x emissions (1990-2000). By 1999, a 1.5 kilotonne-reduction was achieved. By end of 2000, a 17.5 kilotonne-reduction is anticipated.
- In March 2001, the Ministry of the Environment regulated an electricity sector annual cap of 55.1 kilotonnes per year of NO_x and 157.7 kilotonnes per year of SO_2 , to be achieved by 2004.
- The Ministry of the Environment regulated NO_x and SO_2 emissions caps for the electricity sector, of 28 kilotonnes of NO_x (as NO; 43 kt as NO_2) and 131 kilotonnes, respectively, to be achieved by 2007.

A-9 Guideline Boilers and Heaters

- The August 2000 progress report indicated a NOx reduction of 29 kt due to the implementation of the boiler guideline to 2015. Since ASAP industry source partners have provided future estimates of emissions which account for reductions due to this guideline, the full impact of the guideline is not provided here. Rather, the NO_x reduction of 6 kt anticipated from 'other manufacturing' sources, along with approximately 2 kt from commercial, residential, and institutions is provided for a total reduction of 8 kt from these boilers.

Iron and Steel

- Emission reduction estimate has been revised from 2 kilotonnes through ASAP Survey 2000.
- Emission reduction estimate has been revised from 0.4 kilotonnes through ASAP Survey 2000.

Cement

- Emission reduction estimate has been revised from 1.5 kilotonnes through ASAP Survey 2000.

Chemical

- Emissions reduction estimate has been updated from 4.2 kilotonnes through ASAP Survey 2000.

TABLE 2.2.1 -TRANSPORTATION REDUCTIONS

- Ontario Drive Clean program emission reductions are estimated for years 2000 & 2005 only; Drive Clean reductions are not estimated for years 2010 and onwards as the MOBILE 5C model cannot accurately estimate the Drive Clean benefits on the new Tier2 vehicles/sulphur requirement. The Drive Clean program is expected to give additional emission reductions in future years.
- Emission reduction from alternative fuel usage is based on previous Smog Plan report.